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AVIATION

The Oldest American Aeronautical Magazine

Low Pressure Tires ON AIRPLANES

PROBLEMS OF THE *Private Pilot*

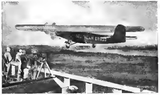
All Steel HANGARS

Nearly a Mile *of* Bounding Jolts *of* Constant Tire Strain . . .

AND THEN OFF TO HAWAII . . . . AUSTRALIA!

ON May 31st, 1928, almost 16,000 pounds of plane and load gathered momentum on the runway of the Oakland Airport.

Four thousand seven hundred feet to the take-off—nearly a mile of bounding jolts and constant tire strain—but at last up and away on a flight that electrified the world! A safe landing in Hawaii — and then to Barking Sands Field



Captain C F Kingsford Smith's Silvertown equipped Fokker Monoplane the "Southern Cross" that flew to Australia in eighty two and one half flying hours

One of the new Fokker 6-seated passenger models demonstrated at the 1929 All American Air Craft Show at Detroit April 6-14 on Goodrich Silvertowns

From here Silvertowns carried the "Southern Cross" *a half mile through yielding sand to another successful take-off*

Trees had to be felled by natives in Suva to make room for a landing. And on *this* improvised field the "Southern Cross" came to a safe stop

Then again by thrilling hops to Sidney, Australia, the final goal of this astounding flight was reached, in eighty-two and one half flying hours!

A significant record for Fokker monoplanes! A significant record for *Goodrich Split-Second Silvertown Airplane Tires!*

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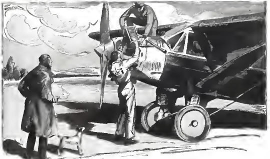

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SPECIFICATIONS

Span Upper Wing	31 ft. 6 in.
Span Lower Wing	31 ft. 6 in.
Wing Area	305 sq. ft.
Height	8 ft. 4 in.
Length Overall	22 ft. 3 in.
Chord	5 ft.
Gap	5 ft.
Stagger	9 in.
Dihedral Upper Wing	None
Dihedral Lower Wing	2 Degrees
Gross Weight	2350 lbs.
Weight Empty	1400 lbs.
Useful Load	950 lbs.
Capacity	Pilot and Two Passengers
High Speed at Sea Level	120 Miles
Landing Speed	36 Miles
Cruising Range	528 Miles

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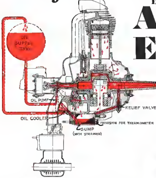

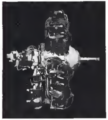

The lubricating oil passes from the supply tank through the pressure pump, on the rear of the engine, entering the hollow crankshaft. The passages for the oil are integral with the crankcase. The oil leaves the crankshaft at the front main bearing, passing through the pressure relief valve, which is built into the front crankcase section. From the relief valve, the oil enters the oil sump, where it is passed through a double mesh oil screen. It then leaves the oil sump via a short external line of ample diameter—the only external line of the entire system—passing through the scavenging pump into the oil cooler. The temperature of the oil is there modified to the best operating point, the excess heat being transmitted to the intake mixture. The scavenging pump adjoins the oil cooler and is connected directly thereto without any piping. The cycle is completed by a connection from the oil cooler back to the supply tank. In addition to the front oil breather, there are two breathers located in the central crankcase section, thus assuring proper crankcase ventilation. Provision is made in the oil sump for inserting a thermometer.

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AXELSON AIRPLANE ENGINES

AVIATION

The Oldest American Aeronautical Magazine

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October 19, 1929
VOLUME 27 NUMBER 16

McGRAW-HILL PUBLISHING COMPANY, INC.
Tenth Avenue at 36th Street, New York, N. Y.
Cable Address Machinist N. Y.

AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

A McGRAW-HILL PUBLICATION — ESTABLISHED 1916

EDWARD P. WARNER, *Editor*

VOLUME 27 . . . *October 19, 1929* . . . NUMBER 16

Over-Production

THE BUILDERS of aircraft face a new problem. For the first time since they began to be liberally financed and to produce airplanes in substantial quantities to meet the steady demand of a commercial market, maladjustment between production and sales has become the cause of serious concern. For the first time, they are in imminent danger of finding themselves with large numbers of unsaleable machines on their hands.

There is nothing to be gained by evading that fact. Over-optimism is a definite industrial danger, as the automobile industry, and many others with it, learned to their sorrow in 1920 and 1921. It would be futile to disguise from ourselves that the estimates of 1929 aircraft production made at the beginning of the year and used as the basis for plans for plant expansion and for employment of personnel, were in most cases far above the reality. Production schedules have had to be hurriedly reduced in some instances. Manufacturing companies confront the future with full confidence in the ultimate greatness of the airplane industry, but with uncertainty about the immediate rate of growth.

We have had the same lesson that the makers of automobiles had to receive, the same that comes sooner or later to almost every industry making a complex and somewhat expensive product for an exceedingly varied market,—the lesson that the product does not automatically dispose of itself, converted into cash, as soon as the paint is dry. Every such industry seemingly must learn for itself that over-production is a practical possibility, not merely an economic shibboleth. The aeronautical world will be fortunate if it learns that fact, and learns it thoroughly, at an early stage of its history, before production of standard models has acquired great momentum and before the sums of capital actually tied up in fixed plant have attained enormous proportions.

If the dangers of excess production be firmly fixed in mind, two policies will be adopted. First, production schedules will be kept flexible to the limit of possibility, the throttle on the factory ready to be pushed wider open or eased back at the slightest change in the reading of the barometer that forecasts consumption. Second, market analysis will be begun and continued with an unprecedented intensity.

Aviation needs intelligently directed sales effort, and lots of it. The potential market for aircraft would consume many times the present production if it could be completely exploited, but before the market can be intelligently attacked it must be defined. Motor boats cannot be sold in the middle of a desert, nor electric fans in Greenland. Airplanes are of many types. For each type there is a definite limit upon the number of possible purchasers, able at once to afford such a machine and to make profitable use of it after buying. We have to determine the present level of those limits. When the market has been studied and classified in every refinement of detail, with the availability of each large group of prospects separately estimated, we shall be in a position to estimate next year's production and that of 1931 with some hope of approximating the truth, and so to lay out production schedules guarding against either excess or deficiency. We cannot do it by pulling inspired figures down out of the roseate sky of our own hopes, nor by the simple and cheery assumption that merely because production has increased at an almost constant rate from 1925 to 1928 it will continue to progress along the same smooth unbroken curve in the future.

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Airport Control

SAFETY IN AVIATION is the resultant of three factors, the man, the machine, and the conditions under which they operate. The Department of Commerce has done much, and is constantly doing its best, to insure and improve the quality of airplanes, power plants, pilots and mechanics. No one is doing anything except in a very few communities, exceptionally enlight-

ened or faced with an exceptionally serious local problem, to protect the public against the deliberate use of dangerously inadequate ground facilities.

No one can survey "aerial service" and "joy ride" operations without alarm at the quality of the fields upon which some of them are based. It constitutes a menace and a scandal. Passengers are being carried every day out of fields that could not get the D4 rating, the lowest that the Department of Commerce offers. They could not come anywhere near it. They could not get an F13, if there were any such thing. That many such fields continue to be used for a considerable period without serious mishap is a great testimonial to the skill of the pilots, but it does not excuse the taking of the chance. We must stamp out the idea that any vacant lot may be an "airport." We must stamp out commercial operations from that kind of field.

Easily said, but how shall we do it? There are at least four ways of varying degrees of desirability and practicability. Number one calls for the amendment of the constitution of the United States to give the Department of Commerce full and explicit power to control intrastate aeronautical activities, as well as those of interstate commerce. That may be dismissed without further comment. Number two adopts the course already followed in Chicago, providing for the licensing of all flying fields by some local authority and prohibiting the use of any not so licensed. A plan capable of having excellent results, so long as the local board remains intelligent and aeronautically expert. Unhappily, it is impossible to expect that men of the caliber of those who make up the Chicago Air Board will be willing to continue indefinitely the gratuitous performance of a rather burdensome service. They will withdraw, and in their place are likely to come political appointees of limited knowledge. None the less, state or municipal licensing is infinitely better than no control at all.

The third possibility is better yet. It leaves enforcement with local authority, technical discrimination with the technically competent personnel in Washington. It calls simply for the enactment by each state legislature of a law prohibiting the commercial use of any field not rated at least D4 by the Department of Commerce or the carriage of passengers off from any below C3 standard.

That would be the ideal, if forty-eight legislatures could all be brought to surrender their blessed conceptions of their sanctified states' right to make their own rules in their own way. Past experience with the effort to secure universal acceptance of Federal licensing of aircraft is not encouraging. There remains the fourth alternative.

The Department of Commerce can reach out and take the authority to control airports. They can do indirectly what they are forbidden to do directly. The Department may not forbid the operation of unsafe fields. That would exceed its constitutional powers. It can, however, forbid any licensed pilot to carry passengers out of an unlicensed field, or one with a rating not high enough to be safe with the particular type of machine that he proposes to use. The Department can do that, and unless state legislative bodies show within the next six months a more intelligent interest in the subject than most of them have so far displayed, we wholeheartedly hope that the Department will.

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The Air Tour's Service to Aviation

ENTERING UPON its fifth annual performance, the National Air Tour remains faithful to its original purpose. Leaving aside the government-operated air mail and a few sporadic and usually short-lived private activities, the inauguration of the Tours preceded the existence of commercial aviation in the United States. The American people were ignorant of aviation and its non-military possibilities. Few of them were conscious of the Air Mail's scope, or had any clear idea of what sort of a record it was making. The National Air Tour in competition for the Edsel Ford Trophy, like the Glidden Tour upon the highway twenty years before, was designed to furnish dramatic evidence of the reliability of a new vehicle. It was to bring visible proof, to all who would take the trouble to go to the flying field and see for themselves, that airplanes could start on schedule and arrive on time, and they could do it not only now and then, by colossal special effort, but as a matter of daily routine. The object of improving the breed of airplanes was a secondary one.

The central aim remains unchanged. Four years have seen enormous progress in the aircraft industry and in aircraft operation, but travelers by air still constitute but a small part of the population. The Air Tour is still needed as a reminder, especially in districts served by no regular air transport line, of the essential reliability of good airplanes manned by good pilots. The record of the first four years has exceeded the fondest hopes of the original promoters. Their contribution to the development of American air-mindedness and to the prosperity of the American aircraft industry can hardly be overestimated.

There has been, and will be, strong temptation to increase the severity of the test very rapidly with the deliberate object of showing up minor defects in design and construction of the competing planes. Any such tendency should be resisted. The National Air Tour should not be planned, as automobile and motorcycle reliability runs frequently are, to break up or weed out all vehicles except the most rugged.

Information concerning the limits of the capacity of airplanes to stand abuse is very useful to their designers but it can be secured in some other way. The Air Tour is for reliability and safety under reasonable conditions. Whatever modifications may be made in the conditions, or in the formula for finding the winners, those factors *must* be kept to the fore.

The Air Tour furnishes annual proof that safety and reliability, with the hippodrome element left out, still interest a crowd. The Tour needs no stunting exhibitions to help it along. If anyone doubts that perfectly straight flying, in sufficient quantity, can still be thrilling, let him reflect to his profit upon the fact that something like a couple of hundred thousand people are visiting the airports of thirty cities in these two weeks to see forty standard commercial airplanes arrive and depart. That fact carries its own lesson.

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A Separate Corner for the Student

THE DEMAND for good commercial aviators has increased so fast that training schools cannot keep pace with it. At the same time there is a tremendous increase in private students. Until a year or so ago the army and navy schools, especially Brooks and Kelly fields at San Antonio, were the principal source of supply for transport pilots. Now the military schools cannot meet the demand, and the War Department has had to take steps to prevent the graduates of Kelly Field from resigning from the service immediately to enter commercial employment.

The natural result has been an increase in commercial schools. On September 15 there were 409 commercial flying schools in the United States listed by the Department of Commerce. They have been growing up practically overnight in all parts of the country with such rapidity that the department field inspectors, of whom there are only five, have not yet been able to deal with all the applications for rating and approval.

Most of the new schools are using fields already in operation, so student training goes on coincidentally with other flying activities. This is permitted, although it is generally acknowledged to be dubious practice. For the present, at least, it is a matter of expediency.

Under the present Commerce Department regulations all-purpose fields are not approved for training unless all parts of the field are available for taking off and landing. If only runways are used, other flying must be suspended during instruction periods.

This is a step in the right direction, of course, but we believe it will be only a matter of time when all student flying is segregated. Not only that, but training fields should be well removed from centers of population and all other flying fields.

Without imposing too much hardship on the schools now in operation, the Department of Commerce ought gradually to tighten its requirements as applied to training fields where there is any large amount of other flying, not only for the sake of the other flyers, but for the students themselves. Learning to fly on some fields we have seen is not unlike trying to learn to drive an automobile on Broadway.

Noise Abatement

CONSPICUOUS among the incompletely solved problems which lurk on the horizon of the airplane designer, dim specters to bring occasional disturbance to his thoughts, is the reduction of the volume and the improvement of the quality of the sound which pours forth from a machine in flight. Noise in the airplane has not been so crucial an issue that the serviceability of the machine absolutely depended upon its control. Other matters have seemed of more immediate urgency, and that one as a rule has been put aside for consideration in some hour of leisure when more pressing problems should have been disposed of. There has, to be sure, been decided improvement in silencing in some cases, especially in large transports, but it has been the result of minor and more less obvious modification in design rather than of such thoroughgoing and fundamental analysis as has been devoted, for example, to developing blind flying possibilities.

The subject is one that will not stand neglect. It should command the active attention of the best brains of the aviation industry. It should be the subject of intelligent basic research. It is by no means beneath the notice of the National Advisory Committee for Aeronautics, and should find a place among the studies undertaken by that body, many of them already completed with such distinguished success, in its laboratories at Langley Field. The matter assumes increased importance with the recent arousing of the public conscience to demand the reduction of miscellaneous noise in the great cities as an intolerable social nuisance and a menace to health and happiness. Already the newspapers that have taken the lead in the anti-noise campaign are training their guns upon the airplane as one of the offenders against peace and quiet needing to be brought under control.

The dilemma has two aspects. It is not enough to cater to the comfort of the passengers inside the cabin by insulating them from the sound. It is not enough to cut down the volume of noise reaching the ears of those dwelling upon the ground. Of the two, the first is the more important, but both are serious problems, and both demand attention. They are coincidental only to a limited extent. Noises may be disagreeable without being penetrating, and vice versa. There have been cases of aircraft, especially those with propellers running at very high tip speed, which produced very different effects upon the ears of the passengers and those of listeners upon the ground. We must bear in mind the feelings both of travelers by air and of those upon the surface. We are optimistic enough to believe that intensive research will remove any ground for serious complaint by either group. In the meantime, pilots must recognize their responsibility to protect aviation against a black eye by keeping a very good altitude, as good as the weather permits, above all residential districts.

Private Pilots AND THEIR PROBLEMS

By Earl D. Osborn

Of ALL the uncertain fields in an uncertain industry, that of the private and plane owner is the most in doubt. We can see maps showing airlines, air mail and passenger lines and we can get figures on the amount of traffic, but try to find out how many private owners there are who fly purely for pleasure and there will be another story, or rather lack of story.

Data is available as to the companies and individuals who own planes and have professional pilots to fly them, but little is known of the private owner who flies his own plane. Yet it is this class who will bring up aircraft sales to the point of real production. Any vehicle which must be handled by a professional, such as a locomotive, bus or steamship, is comparatively limited in its production. In the early days of the automobile there were proportionally many more chauffeurs than there are now, and mass production did not start until automobiles were taken up by the private owner and driver. The same will hold true of the airplane.

What then are the prospects for the development of private flying? This subject has been discussed many times without any conclusions being reached. The writer, who is not a professional pilot, has owned during the past seven years, two flying boats and a land plane. He still does not feel competent to decide the question, and can only add a few random thoughts.

In the first place, a lot of sport can be had out of flying for pleasure. Although the element of competition is lacking, flying is enough of a game to keep one interested. It requires skill to make a turn well, and it requires skill to land a plane gently and in the exact place that one wishes to land. By instrument and by feel one knows if one is flying well and it is very easy to tell the difference between a good and a bad landing. It is surprising to find how much better one flies on certain days than on others. Then there is the weather question. Conditions are always different and the difference lends variety even if the flying is done from a fixed base.

There is always something new to be learned. When straight flying has been sufficiently mastered, various forms of acrobatics can be practised. Most private fliers will not want to go far into stunt flying but a certain amount is almost necessary and, if attempted intelligently, will prove most interesting. Then there is the field of instrument flying. Blind flying in bad weather is only for professionals but instrument flying can be practised at high altitudes either by keeping one's head well within the cockpit or by flying through small clouds.

Flying is a sport like riding to hounds, or sailing. It remains an adventure, even to those who have done a lot of it. There is a thrill in the contact and combat with the elements which is latent even in those bred in the city. To many, a sense of danger is an added touch of spice without which flying would become monotonous. If private flying always remained limited to those who have the sporting instinct, it would still continue to have its devotees, but their numbers would be limited.

At present, private flying for business purposes has very decided limitations. It is too unreliable, too expensive, and too inconvenient. Scheduled operation of airlines has only been obtained by very careful ground organization applying both to the maintenance of planes and to weather reporting. Even at that, there are considerable periods when weather conditions prevent scheduled flights.

The private flier has not the facilities for getting weather reports and he has not the experience, the ability or the inclination to fly through thick weather as does a professional pilot. Also, in most cases he will not trouble to find out what the weather is unless obtaining reports is made easier than it is today. When appointments must be kept and a man is busy, he cannot afford to wait on the weather. There are times when the private plane flown by the owner really saves time, but on the whole the time taken in fueling, seeing that the plane is in good shape, getting it out of the hangar and warming it up more than consumes the time saved. There are places where transport facilities are poor and where planes save time for their owner, but in the majority of cases it will be found that private pilots are not using their planes for business transportation in competition with trains or automobiles.

Rear quarter view of a Fleet biplane powered with a Kinner K5 engine

A view of the clubhouse hangars and field of the Long Island Aero Club Hicksville, L. I., N. Y.

This situation will be greatly improved by better facilities for the maintenance of private planes, and especially by better and more readily available weather reporting. More airports along the routes traversed will also be a great help.

The drawbacks which apply to business flying do not apply to the same extent on cross-country flights which are made primarily for pleasure and only secondarily to get to a destination at a given time. And there is a growing use of planes for week-end visits.

Some years ago a wealthy private plane owner was asked what it cost him to operate his plane. His reply was that he had never kept any cost record for if he did he would probably decide that it was too expensive. The same situation, unfortunately, applies to a considerable extent today. One cannot neglect maintenance on a plane and engine and unless an owner has the time and ability and desire to do the work himself he will pay good round prices for maintenance. The private owner will in most cases pay more per flying hour than does the professional operator if only because of the fact that he does not use his equipment as systematically or intensively. This situation is also being remedied by better and more reliable planes and engines, and also by the development of better servicing facilities for private planes.

There are some people who predict a very rapid growth of privately owned and flown planes. The writer, after some 200 hours of solo, feels that there will be a steady growth of those who fly for pleasure, but he cannot persuade himself that there will be an enormous expansion until flying is made very much easier than it is today. There are private owners who do not question their ability and yet do not crash. These are either born lucky or else are those rare birds who are natural fliers, just as some few people have an athletic facility which enables them to star in any game that they enter.

The majority of private fliers and plane owners who try to do more than their skill and practice warrants sooner or later have trouble. The average private flier does not have the time to become, or even stay, an expert. There are practically no good golfers who do not play for six or eight hours a week and flying takes just as much time. Safety in flying requires practice, and as far as can be ascertained, few private planes owners fly as much as 200 hours a year. The average would probably be under 100 hours, and that is not enough. This can be proved statistically by the records of the Army or Navy and by insurance figures. It also is brought home to the amateur flier when he undershoots or overshoots a field or when he finds himself skidding or slipping when turning close to the ground. There are few times when an amateur goes flying that he does not flub some maneuver, just as there are few times that an amateur golfer does not flub some shots. In golf, missing the ball means a higher score, in flying, missing the field may mean something more serious.

The average private owner feels more comfortable if he is somewhere in the vicinity of his own field. Flying cross-country may mean a forced landing in a small field, it may mean running into bad weather and, in all events, it means landing in a strange field. The majority of private owners do not fly long distances cross-country except occasionally, the greater part of their flying hours are put in around the home airport. The average amateur pilot can fly better near his own airport and can make better landings and take-offs because he can concentrate on his flying and does not have to locate possible obstructions.

The weather question also keeps many fliers near their home field. There are few amateur fliers who do not feel uncomfortable when they are flying on a very bumpy day. When close to the home airport the amateur feels that if the weather gets too thick or too boisterous he can land, whereas he would not like to have to fly through a storm with the possibility of a forced landing in unfamiliar country.

To those who have exceptional natural flying ability, and to those who have the time to put in four or five hours a week of flying, these limitations do not hold, but to allow the average private owner to extend his range flying must be made easier. More than 85 per cent of airplane accidents are attributable to some extent to faults in piloting. This is another way of saying that the flying of an airplane is too difficult.

Part of this, in the writer's belief, is caused by the fact that the airplane of today is designed for pro-

fessional users. All test pilots are professionals and what they want is different from what the private pilot wants. Up until the last few years, most designing was for military purposes, and what is needed for the military services is not what is needed for the private pilot. Manufacturers of airplanes, although they have considered the question of private flying, have been tied down by military tradition and by the verdict of professional pilots. If the Guggenheim Safe Airplane Competition does nothing else, it will draw the attention of manufacturers to the fact that there are other flying characteristics which may be as important as those they have been trying so hard to achieve.

What does the amateur pilot want? He wants a plane which positively will not stall or spin. Planes have been built which are very hard to put into a spin and many prominent engineers claim that it is possible to build a plane which cannot stall or spin. The amateur flier wants a plane which will glide under full control at a much steeper angle than that of present planes. Skilled pilots lessen their gliding angle by side-slipping, fish-tailing, etc., but the average amateur feels some uneasiness in the violent application of these maneuvers. What he wants is a plane which, besides being able to glide at ten to one, will also glide at an angle of four to one or better and at a relatively low speed. That, incidentally, is one of the requirements in the Guggenheim Safe Aircraft Competition. Such performance can only be obtained by squashing down beyond the stalling angle. There are planes which will settle at this angle but should one try to land this way, there would be great danger of stalling and there are few landing gears which would stand the shock.

It does not seem impossible to design a plane which the pilot could land by pulling the stick back and letting it squash down at an angle of four to one until it hits the ground. If all a pilot had to do was to pull the stick back and keep the plane in lateral balance and headed into the wind, his job would be easier than at present. A gliding angle of four to one would require much less accurate judgment of height and distance than an angle of ten to one, and would make flying much easier. Many designers may say that this cannot

be done. This may be true but it certainly is true also that it will never be done unless designers concentrate upon the effort.

To a professional pilot, a landing speed of 60 m.p.h. may not be excessive, but the amateur, without an instinctively correct use of the control, has to give part of his thought to his plane and cannot concentrate

An aerial "shot" of an Arrow Sport biplane in the air

on possible obstructions or other planes. The slower a plane lands, the better it will be for a private pilot.

If there were no danger in flying slowly and if planes would come down at an angle of four to one, half the battle would be won. If it were easier to learn how to fly and if it did not require such skill to land planes in small fields, the number of private owners would increase greatly. This would automatically solve many of the problems of high cost, service, weather reporting, etc. Until designers and manufacturers realize that the present-day airplane is limited as far as private flying is concerned, there will be little progress. The demands of the private flier are different and perhaps much more difficult of achievement than the demands of the professional, but there is no reason why they cannot be solved provided that the problem is really tackled systematically and with courage.

Showing how the wings of a Gypsy Moth may be folded for hangar storage

However, enthusiasts will continue to fly for sport with airplanes of the present day type. There is an ever-increasing number of motor boats being sold, though they are limited by weather and can rarely be used for business. The same will hold true of the airplane. Each sport has its "fans," but fans rarely build up a great industry. Flying must be made easier before airplanes will be sold to all those who can afford them.

HEAT TREATMENT of *Alloy Steels* in AIRPLANE WORK

Methods and Equipment Employed in the Recently Completed Fairchild Factory at Farmingdale, L. I.

By C. B. Phillips
Vice President, Surface Combustion Company

The development of steel alloys and heat treatments to bring out certain desired physical characteristics has been one of the greatest aids to the advancement of aviation. Stronger and lighter construction both in the plane itself and the engine, are goals sought by all airplane designers and it is here that the metallurgist becomes a main support of this industry.

One of the strictly modern airplane factories in the world has just been completed by the Fairchild Airplane Mfg. Corp., Farmingdale, L. I., N. Y., and its metallurgical department is complete in every respect. This concern needs no introduction for it was a Fairchild which took Collyer and Mears around the world in 23 days, a Fairchild that first reached the stranded flyers of the Bremen on Greenly Island and a Fairchild in which Byrd first explored the territory around the South Pole.

The Surface Combustion furnaces at the Fairchild plant

The Fairchild Airplane Mfg. Corp., one of the subsidiaries of the Fairchild Aviation Corp., is among the largest manufacturers of single engine cabin monoplanes in America. It also builds engines, flying boats and floats, its latest type of engine being the Genet, of English design, which it is making under license. This engine is rated at 80 hp. and of the radial air-cooled type.

More than ten different alloy steels go into the manufacture of the planes and engines made by this company, and most of them are heat treated to bring out the greatest strength and toughness, and other desirable properties. Tubing for the fuselage as well as welded fittings are made of a chrome-molybdenum steel of the following analysis:

Carbon	0.25-0.35%
Manganese	0.40-0.70
Phos	0.040 max.
Sulphur	0.045 max.
Chromium	0.80-1.10
Molybdenum	0.15-0.25

This alloy is used because its strength is least affected by the process of welding. The heat treatment used consists of heating to between 1,550 and 1,650 deg. F., quenching and drawing to the required hardness.

Fittings that are brazed with a gas torch instead of welded are made from a low carbon steel the analysis of which is:

Carbon	0.20-0.30%
Manganese	0.50-0.80
Sulphur	0.45 max.
Phos	0.05 max.

The same heat treatment as described is used except that a temperature 25 deg F higher is used

A nickel steel is used for bolts, taper pins and small machined parts and is of the following analysis

Carbon	0 25-0 35%
Manganese	0 50-0 80
Phos	0 04 max.
Sulphur	0 045 max
Nickel	3 25-3 75

As these are for the most part produced from bar stock the only heat treatment is to heat to 1 450-1,500 deg F, quench in water and draw to the required hardness The quench gives a tensile of better than 150,000 lb to the square inch with a yield point in excess of 125,000, but these drop with the draw

CASE-HARDENED PARTS, such as piston pins, cam follower tappets, valve cams, etc, are made from a chrome-nickel steel of the following analysis.

Carbon	0 10-0 20%
Manganese	0 30-0 60
Phos	0 04 max.
Sulphur	0 045 max
Nickel	1 00-1.50
Chromium	0 45-0 75

Naturally maximum hardness of the case and maximum refinement of both the case and the core, together with a minimum of distortion, are required, and in order to provide these characteristics the parts are first carburized at 1,625-1,675 deg F., after which they are allowed to cool in the boxes. They are then reheated to between 1,400 and 1,450 deg F, quenched and drawn at from 250-500 deg F as requced

Forgings for airplanes and fittings machined from bar stock, etc, such as wing hinges, strut links, strut sockets, ball ends, etc, requiring greater strength and toughness than are obtainable with plain carbon steel, are made from a chrome-nickel steel very similar in analysis to the one just described The differences include 0 20 more carbon and more manganese. As the grain structure of forgings is less uniform than that of bar stock in most cases, they must first be normalized by heating to from 1.625-1,725 deg F The heat treatment for both forgings and bar stock products produced from this alloy, and exclusive of the normalizing of the forgings, consists

Above—Photograph showing the heat treating equipment installed at the plant of the Fairchild Airplane Manufacturing Company at Farmingdale, L I Much of the equipment in this department has been furnished by the Surface Combustion Company Below—A portion of the assembly line at the Fairchild plant where several types of airplanes are built

An aerial view of the airport, plant and hangar of the Fairchild company at Farmingdale

of heating to 1,475-1,525 deg F, quenching in oil, and drawing to the required hardness.

For studs, engine rocker arm forgings, crankshafts, connecting rods, etc, a chrome-vanadium steel is employed, as these parts require greater strength, toughness and resistance to fatiguing conditions than is possible to obtain with plain carbon steel The analysis is as follows

Carbon	0 30-0 40%
Manganese	0 50-0 80
Phos	0 04 max
Sulphur	0 04 max
Chromium	0 80-1 10
Vanadium	0 15 min (0 18 desired)

The forgings must be normalized, as outlined in the preceding paragraph, after which they are reheated to 1,550-1,650 deg F, quenched in oil and drawn to the required hardness Those parts which are to be machined after forging and before heat treating are first normalized and then reheated to 1,250-1,350 deg F, allowed to cool slowly and then machined After that they are reheated again to 1,550-1,650 deg F, quenched in oil and drawn

Parts that require still greater strength than is obtained in the foregoing alloy, such as valve springs, gears, couplings, etc, are made from a steel similar in analysis but with a 0 10 higher carbon content These are normalized at 1,650-1 750 deg F, reheated to 1,525-1 625 deg F, quenched in oil and drawn For parts, such as gears, that are to be machined after forging, the same heat treatment is employed with the exception that they are reheated to 1,250-1,350 deg F and cooled slowly after normalizing They are then machined and the rest of the heat treatment then applied

ANOTHER CHROME-VANADIUM STEEL, which is primarily a tool steel is used somewhat in anti-friction bearings, the application in this plant being in push rod ball ends, rocker arm rollers, etc, and has the following analysis

Carbon	0 90-1 05%
Manganese	0 20-0 45
Phos	0 03 max.
Sulphur	0 03 max
Chromium	0 80-1 10
Vanadium	0 15 min (0 18 desired)

In heat treating, the parts are first normalized at 1,650-1,750 deg F and cooled to 1,000 deg F, black heat, by opening the furnace. They are then reheated to 1,300-1 350 deg F and soaked for at least 36 hr, or until the desired structure and machinability are produced, after which they are cooled slowly in the furnace The parts are then machined when they are heated to 1,500-1 550 deg F, quenched in oil and drawn

THE HEAT TREATING DEPARTMENT is equipped with the latest and most modern heat treating units There are seven furnaces, including an oil draw, all fired with gas The four largest are standard units made by the Surface Combustion Co, Toledo, Ohio

The cast-iron sectioning is so designed that the warping stress is successfully resisted and there is no tendency for the furnaces to spring out of alignment. The linings are of 4½ in firebrick and tile—thick enough to maintain rigidity but not so thick as to absorb and retain any large quantity of heat. The 2½ in of heat-resisting insulation is most effective in preventing radiation losses, either through the furnace walls or doors A marked improvement in working conditions is thus realized

The largest of these furnaces is 8 ft long, 3 ft wide and 20 in high, inside dimensions This unit is equipped with five high pressure gas burners on each side, manifolded to Surface Combustion inspirators This system of firing provides an effective temperature range of from 700-1,650 deg F and in addition automatically maintains perfect combustion and the desired furnace atmosphere, regardless of pressure changes in the air or gas supply lines

The firing is so arranged that the heat is rapidly and uniformly distributed to all parts of the furnace from a restricted and controlled zone of combustion. This system of firing and the use of single valve control leads to noteworthy economies in fuel and also in labor, while production is put on a sure basis

The other furnaces are similar in design and construction but of somewhat smaller dimensions All are provided with automatic temperature controls so that when the proper time cycle is maintained there can be no variation in the heat treatment from one charge to another.

NATIONAL DISTRIBUTION THROUGH *Factory Branches*

By R. Sidney Bowen, Jr.

IN THE OPINION of the officials of the American Eagle Aircraft Corporation, Kansas City, Mo , there is no such thing in the aeronautic industry as an airplane distributor At first glance, such a statement might cause certain gentry of the aeronautic industry, who quite justly regard themselves as airplane distributors, to rise to the occasion and remark in no uncertain terms that some one is traveling under a most appalling misapprehension However, when duly explained, the opinion of the American Eagle officials more or less hits the nail on the head.

When one takes the automotive distributor as the pattern, there is indeed "no such animal" in the aeronautic industry The automotive distributor has a display room which includes every model produced by the manufacturer that he represents In other words, the entire line is on display for all who care to come and inspect They are not removed for demonstration purposes or otherwise, but remain "as is" until relegated to "the back row" to make room for the year's new designs

With but one exception, there is not, to our knowledge, a single distributor of airplanes who has on display at some central point, the complete line of planes that he represents The principal reason, is, undoubtedly the matter of financial outlay Another is the lack of *suitable* display space And a third, is probably because the distributor never considered the idea due to the apparent uneconomical policy of having money tied up in non-moving stock . . . particularly in this early stage of aeronautical merchandising However, whatever the reasons Mr Customer is forced to inspect a demonstrator at the local flying field, as conditions are today He can not visit some downtown establishment and look over the entire line of models, prior to visiting the field with the idea of getting a demonstration in the product which momentarily strikes his fancy

The result is, according to the American Eagle officials, that many sales are lost They are firm in the belief that the customer should have all the "wares" paraded before him as it were And when one considers the difficulty in getting many prospects to go out to some distant flying field, in order to make a first hand inspection, that belief appears to be quite true

The question which quite naturally arises at this point is . . . if there is no such animal in the aeronautic industry as an airplane distributor, then how is distribution "efficiently and profitably" handled?

Perhaps the answer may be found in the policies and methods of the American Eagle Aircraft Corp

Originally, that company worked along the distributor and dealer idea, but when the sales ledger pointed out its weak points . . . and in a most forceful way, incidentally . . . it was decided to do away with distributors, and in their place set up factory branches, completely owned and operated by the Kansas City company In addition to the factory branches other sales agencies for American Eagle products were appointed and although such agencies might be referred to as distributors, they are in reality merely dealers And in order to further increase the size of the national selling organization, to make sure of complete coast-to-coast coverage, the factory-appointed selling agencies are permitted to appoint associate dealers, such as persons or organizations not interested primarily in the sale of aircraft

E. E. Porterfield, Jr president American Eagle Aircraft Corp

The policy of establishing factory branches was of course decided upon as the result of the existing distributors not desiring, or not being financially able, to carry a complete line of American Eagle products The men put in charge of the factory branches were those persons who functioned as roadmen or field sales engineers, under the original plan The personnel of each factory branch is made up of men fully experienced on American Eagle products Factory branches that have been established are in Portland, Ore , Glendale Calif , Dallas, Tex , Montgomery, Ala , and Minneapolis, Minn

NOT ONLY do the factory branches act as selling establishments, but they also act as complete service stations also, as a very complete stock of parts is carried by each branch The parts are, of course, not only used at the branches but are redistributed to the various other American Eagle outlets located in the field Thus it will be seen that the American Eagle Company has linked up national sales and service in such a manner that either the prospect or customer-owner is well cared for

Naturally it follows that it would be highly uneconomical for the American Eagle Company to establish factory branches at every spot that boasted of an American Eagle "population" Therefore, the company officials analyzed the country most intensively before deciding upon the location of the factory branches While all of the factory branches planned have not as yet been established, those that have been give indication of the idea behind the entire policy And that idea is to so place the factory branches that every prospect is within two and one-half to three hours of a demonstration on any type or model produced by the American Eagle and its subsidiary organizations

A Kinner powered American Eagle Sport biplane in the air over Kansas City

THE REMARK might be made at this point . . . that few persons are going to hop aboard a train to travel to some distant city in which a factory branch is located, in order to get a demonstration Perhaps that might be true, regardless, in some cases However, as a means of rendering the best type of selling service to a prospect, the company has appointed what are known as district managers These managers are situated throughout the country in parts not "favored" with factory branches Their work is to contact their district and do everything possible to boost sales and service within their domains They are on the American Eagle payroll and have direct contact with the Kansas City office Each district manager has a demonstrator, just as the other appointed selling agencies and associates have demonstrators However, the district manager functions more as a field sales representative, in that he continually contacts neighboring points in his district

The manner in which the factory branch functions with the district manager is perhaps best illustrated by the following example

Let it be assumed that the district manager located in San Francisco has contacted a prospect to the point where that prospect is seriously considering a purchase, but considering the purchase of a model not carried by the San Francisco district manager The nearest factory branch, where all models may be inspected, and a demonstration made on any one of them, is located at Glendale, on the outskirts of Los Angeles, Calif Thus the district manager invites the prospect to fly with him to the Glendale factory branch . . . a matter of a two or three hour flight (depending upon those famous Californian tail winds) When the district manager and "party" arrive, said party is then able to "see for himself" on the salesroom floor, or in the air And naturally, said party is the guest of the district manager on the return trip to San Francisco

Completed OX5 powered American Eagle biplanes ready for test flight and shipment

The entire procedure, that of inviting the prospect to make the trip down, flying him down, the inspection of the entire line of models, a demonstration in those that meet his fancy, his signature on the dotted line (we hope) and the return flight to San Francisco can be carried out in the space of a few hours.

It is readily admitted that the above mentioned procedure does take a certain amount of time . . . perhaps enough to cause the prospect to lose a business day. However, the advantages of such an arrangement are so beneficial to the prospect, to say nothing of the advantages to the American Eagle sales ledger, that the possible disadvantage to the prospect losing a business day, is really far overshadowed.

In the first place, the prospect has a real opportunity to "shop." He can inspect the entire line of "goods" offered, and does not have to go on a salesman's declarations, or those printed in folders and descriptive catalogues. In the second place he can obtain an extra long demonstration flight in an American Eagle product. And in the third place, he is able to learn first hand of the facilities that the company offers regarding the maintenance servicing of his plane in the event that he makes a purchase. In short, the arrangement eliminates any "grab bag" purchase by the customer. He has the opportunity to find what he wants, inspect what he wants, and purchase what he wants.

The same advantages are of course equally favorable to the selling company, if not more so. They at least permit the company a maximum of opportunity to get the signature on the dotted line. To state which advantage carries the most benefits is rather impossible, as all three are so interlocked with the ultimate goal, that of a sale of an American Eagle product. However, the establishment of the factory branches is the only means by which the advantages are made possible. Therefore, perhaps the first is paramount.

Reverting to the selling agencies and associates appointed by the factory, it might be of interest to note that there is no such thing as a closed territory under the American Eagle arrangement. The reason for such a policy is, according to the officials of the company, because of the complaints regarding split commissions that were received from distributors and dealers in the field. As a means of removing the possibility of dissatisfaction "in the field" the company decided to adopt the "open season" policy from coast to coast.

Incidentally, it should prove of interest to follow the progress of this open territory policy as it is one of the few cases existing at the present time in the field of aeronautics.

In the automotive industry it is an old, old problem which, according to many in the position to state, has not as yet proved successful one way or the other. Particularly so, in the merchandising of replacement parts and accessories. Those that favor closed territories do so because they believe that it enables the distributor or dealer, as the case may be, to better develop his territory. When forced to compete "in his own backyard" the closed territory advocates feel that the distributor or dealer is prevented from building up toward the goal of maximum sales quota.

On the other hand, those that favor open territories do so, because they feel that "outside" or "neighbor" competition is the best means of keeping the local distributor and dealer on his feet and "after the ball" every minute of the working day. If presented with a closed territory, they feel that the distributor or dealer is tempted to adopt the "now come to me" idea . . . and to merely scoop up the ready sales "cream" and then sit back and develop into a "split commission hound" . . . in other words, reap 50 per cent of the benefits of an "outside" sale, without the exertion of any sales effort on his part.

Both sides undoubtedly have presentable arguments, and perhaps there is no solution that can apply to both. Experience, as in the case of the American Eagle Company, proves which idea to be the best for a particular organization to adopt. However, as mentioned above, in view of the fact that the American Eagle Company is one of the very few organizations in aeronautics that have adopted the open territory policy, it should prove of interest to note the success of the policy as time goes on. Thus far, it is operating to the complete satisfaction of the factory officials.

The problem, or rather the task of enforcing the policy of distributors and dealers not handling competitive products, is one which has not caused any loss of sleep by the American Eagle sales management. The fact that the factory branches act as the real distributors may have something to do with it . . . but at any rate the company does not insist of the non-competitive policy owing to the fact that the selling agencies and associates handling American Eagle products, handle those products exclusively of their own volition.

A liberal commission for sales consummated is allowed and of course, each factory branch co-operates with adjacent sales outlets in the same manner as would the Kansas City factory itself. Any "tough" prospect that needs additional "closing" is a service rendered by the factory branches and the district managers. The factory branches will also make the necessary hook-up for the financing of any sales.

While this article has dealt with the American Eagle policies and methods in the matter of obtaining maximum national distribution, a few words regarding a service to owners of American Eagle products might not be out of place.

In the event of a minor accident to a plane, such as a ground-loop, that results in the snapping of undercarriage struts, or a crumpled wingtip, etc., the average plane owner has no idea of what it will cost him to repair the damage. And of course the owner "remains in the dark" until the local dealer or service station views "the remains" and makes an estimate. Sometimes the owner is forced to write to the factory for prices of new parts. Particularly, is such the case, when the owner desires to replace old but not damaged parts, or obtain additional "gadgets," etc.

To enable the owner of an American Eagle product to readily find out for himself the material charges on the repair of his damaged plane, the company supplies each owner, at the time of purchase, with a complete and detailed catalogue containing a description and price of every part of his plane in addition to all the "trimmings" that may be attached if desired. The parts catalogue is so made up that new factory additions, mailed out from time to time, may be "hooked in" with the rest.

Naturally the American Eagle parts prices are standard throughout the entire country. Thus any American Eagle owner, no matter where he may be located, can order any part or bit of "trimming" that he desires, and know just what it is going to cost him.

THE WHY OF Steel Built HANGARS

By M. S. Locke
*Airport Division Director, Sales Promotion Manager,
The Esline Company, Oconomowoc, Wisconsin*

A NEW INDUSTRY APPEARS—a new industry needs buildings. What are its requirements? How should those buildings be built and of what?

To begin with, every building material has some advantages—some more or less than others. The trick is to find the *one* material that incorporates as many of the advantages as possible of all the others, adds a few of its own, and has none of the disadvantages of any of the others. Is there any such material? Probably not, but there may be one that comes close.

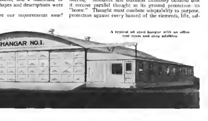
Aviation "zoomed" upon us with a rush. Engineers and pioneers had proved to themselves and a select circle of supposedly superhuman beings the practicability of flight. Public opinion had not accepted it. To them flight was a hazardous "stunt." Then a boy with typical Yankee nerve demonstrated the courage of his convictions by spanning the sea,—by air—alone—Col. Chas. A. Lindbergh. Contact! was heard everywhere—individuals, railroads, business firms, and governments climbed into cockpits and cabins. Aircraft factories were swamped with orders. The story of the still incomplete development of aviation is not a mystery, you know it and I know it. New aircraft appeared on hundreds of fields. Immediate shelters were needed, the line of least resistance was taken. Temporary frame hangars were built, tents were used, old barns, and a multitude of structures of various kinds, shapes and descriptions were pressed into service.

Aviation is here—what are our requirements *now?*

Let us take a few accepted facts and jot them down just to see what happens and what the total may be. Aviation, while here and practically accepted, is still in its infancy. The airport requirements of today may be obsolete tomorrow. Airports may have to be moved or enlarged to meet necessary demands and changing requirements. Flying is now a business and every phase of its development must be treated from a sound business basis. Executives, to provide a firm foundation for development, must apply those same principles that have been the proven characteristics of every successful endeavor. The principal one of these is Business Economy.

Business economy has several contributing factors. Since hangars are the keel of our discussion, the eye of Business Economy must be focused on a building. What constitutes Hangar Business Economy? What is a hangar? What does it do?

Our friend Webster says in brief and without embellishment, "Hangar—a shed for the housing of airplanes." The best brains in the country are devoting time, energy, and the expenditure of billions of dollars to the development of aircraft. Your plane is the result of the nth degree in modern mechanical and aerodynamic thought. It is a costly scientific work of art and engineering. Romance and Business Economy demand that it receive parallel thought in its ground protection, its "home." Thought must combine adaptability to purpose, protection against every hazard of the elements, life, sal-



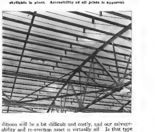
A typical all steel hangar with an office rest room and shop addition

vageability, first cost, depreciation

Wood is an age-old structural material Does it "fill the bill," so to speak? It is easy to get lends itself admirably to building problems Wood structures may be considered more or less permanent Additions and repairs can be made easily. Primary erection cost is economical A good 100 ft x 100 ft can be built for about $13,000 Its use should give us the foundation of good Business Economy Does it?

By its very nature, it is, even with the best of care, subject to deterioration and decay It is easily inflammable Used on an airport in a district beyond fire control, as airports generally are, it presents an unquestionable hazard The insurance rate looks a bit prohibitive Not more than 50 per cent of the total value is insurable No one insurance company seems willing to carry it, but insists on dividing the risk with other companies Aviation history records that where fire occurs there is usually a total loss And we must use unusual care in the selection of our lumber How shall we determine its quality? Is there any fixed equation we can use to assure ourselves that each piece is the same, has the same strength, has definitely been subjected to the same period of seasoning? Will our doors always hang properly run true and easily? Will our windows stay in a fixed position? Will all of our joints remain tight and weather resistant? Will our walls or roofs warp or get out of shape? What is our factor of safety in high winds? What is the experience of users of strictly frame buildings in comparison with other types? Aviation history has recorded many losses caused by high winds

Above The interior of a typical all steel hangar showing the sturdy superstructure and full unobstructed interior Below The roof structure with insulation, roof vents and skylights in place. Accessibility of all joints is apparent



What is our salvage value should a moving and re-erecting necessity arise? Can we dismantle our frame hangar entirely and rebuild it on our new location without loss? That is an important point Our aviation project is in its chrysalis stage Considerable changes will probably be necessary in our frame hangar Will those pieces we deem worth saving give us maximum service in the re-erected structure?

In order to heat our frame hangar, we must add inside sheathing and a very good building paper between that and our outside siding That will materially increase our expense, nearly double our erection problem, and add an almost prohibitive obstacle to our salvage and re-erecting problems

Another possibility is a steel and brick or steel and concrete hangar Very excellent, but does it fit in our program of necessary Business Economy? Our first cost for a 100 ft x 100 ft will be $40,000 or $50,000 We will have a substantial fireproof, weather and wind proof, easily heated building of architectural beauty Additions will be a bit difficult and costly, and our salvageability and re-erection asset is virtually nil Is that type of structure exactly what we want? Is our aviation project sufficiently definite in all its requirements? Is our airport location permanently fixed? I am afraid not

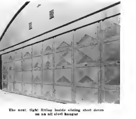
What is our next option? An all steel hangar We can build a dandy 100 ft. x 100 ft. x 18 ft for $15,000—much lower than brick and steel or concrete and steel. A little higher than wood Isn't it worth it? Is it really higher—isn't it cheaper in the end, all points considered in our platform of necessity and business economy? What do we get? What is the opinion of others in this regard? We find at least one that we believe is typical Mr Archibald Black in his recent book "Civil Airports and Airways" says, "The all wood hangar can be regarded as a permanent type of construction and has been used to quite some extent in this country. It was, in fact, the first to be used. This type is, however, rapidly being supplanted in public favor by the all steel and factory types which have the advantage of longer life, better appearance and lower fire risk "

Mr F. H. Frankland, Technical Manager, American Institute of Steel Construction, in a recent article on the subject says in part, "We can profit from the experience to date of aviation activities in Europe, comparatively slight though it may be In the building of hangars and other airport structures, we must keep in mind that the science of aviation is rapidly changing with a consequent swift rate of obsolescence Buildings must afford those accommodations required of them, but they should likewise be subject to easy and inexpensive structural change A hangar or structure possessing no salvage value and which cannot be removed without drilling or blasting is hardly the most efficient which can be erected at an airport, and a building which is easily inflammable would hardly offer the protection which the airplane and its accessories demand "

Let us consider the adaptability of these materials to our purpose No other building material approaches steel in strength A laterally supported, solid steel column $3\frac{1}{2}$ in. high will support its own weight without crushing A steel chain, hanging in tension, would be 18,000 ft long before its weight would break the topmost link Steel has the ability to meet every kind of stress, or a combination of all of them, with more strength than is possessed by any other material Every process in the making of steel from its refinement in the open hearth furnace to its final passing through the rolls, is supervised and safeguarded with one purpose to maintain uniform quality Steel is worked and reworked, rolled and rolled again, until the metal has a uniform, fine-grained, tough texture. It can have no hidden weakness. It is proved right in the making The chemical properties of steel are more accurately fixed than are the properties of a medical prescription compounded by the most expert pharmacist

Metallurgists and chemists have controlled the manufacture of steel. Engineers have planned and checked its fabrication In no other building material can we get such known strength and uniformity Steel comes to the job ready for erection, ready to be erected immediately Every member is a unit with a definite position in the structure and it can be placed in its proper position without delay. If you have marvelled at the speed with which a tall building rises, you know how swiftly it is possible to build hangars with steel

The inherent strength and stamina of structural steel mean that less bulk of material is necessary for safe construction Where load values are high a far more adequate structure can be erected with steel than with any other material Steel columns and beams occupy less space consequently, interiors can be larger with construction members less conspicuous The compactness of structural steel facilitates rapid and economical construction No false work, staging, temporary supports, or forms are necessary Structural steel goes into place cut-to-fit, complete, self-supporting Workmen have the full use of floor space as the work proceeds Structural steel maintains its strength to a remarkable degree in the presence of heat Investigations have shown that it actually increases in compression strength with a rise in temperature, reaching a maximum at about 500 degrees Fahrenheit At 700 degrees, it is practically as strong as under normal conditions The Bureau of Standards in Washington and the Underwriters' Laboratories in



The neat tight fitting inside sliding steel doors on an all steel hangar

A typical steel hangar, belonging to Governor Kohler of Wisconsin

Chicago, in conducting extensive tests on the action of structural steel members at temperatures up to 2,300 degrees Fahrenheit have found that a steel column with a casing of fireproofing will sustain its load under conditions reached in the most severe conflagrations.

In a steel frame every member is an integral part of the whole, thereby contributing to the support and strength of every adjacent member. Structural steel will last indefinitely. Bridges and other steel structures exposed to air and moisture require only cleaning and painting at intervals. The consensus of opinion among leading engineers is that no steel structure, which has the most casual attention, has ever been seriously effected by corrosion. The permanence of steel is a characteristic of the metal, determined by the standards of its composition, manufacture, and fabrication. Fixed scientifically it is a factor not dependent on construction conditions or the human equation.

All structural steel members are designed with a big reserve of strength and endurance—a positive assurance of true permanence. Structural steel is strong and resilient. It has the property of recovering quickly from great shock and strain without any impairment of strength and durability. The raw materials from which steel is produced are subjected to accurate analysis. The refining process is carried on under careful metallurgical supervision. The process of making structural steel, which includes repeated rollings, gives to the metal a tough and springy structure. This characteristic of the material makes the steel beam or column stubbornly elastic. Structural steel will give, almost imperceptibly, under heavy shock or load and recover its original form without fatigue or failure. Every step in the shaping and in the fabrication of finished steel is accompanied by close inspection. Rolled structural shapes are checked by chemical analysis and physical test before they leave the mill. The quality of steel must conform to an established standard—it must respond to accurate test requirements before it can be sold. Structural steel must be consistently uniform in quality because the same high standards of physical strength and chemical composition are strictly adhered to by all steel makers in the United States and Canada. You may buy steel, produced by any of these manufacturers with the full assurance that it will conform to the recognized standards. Its physical and chemical qualities are frozen into it at the mills.

All the characteristics of every member are computed when the building is designed. The strength of structural steel is a definite consistent figure. Additions or alterations can be planned with the same mathematical accuracy, and carried out with the same speed and economy that save time, labor and material in the original structure. A steel hangar is altered by connecting new members of the proper size to the original frame, making them a component part of the building. Extensions or alterations to structures built of other materials do not have the advantage of complete unity and consolidated strength that is made possible by structural steel. The construction of structural steel can proceed regardless of weather conditions as long as men can work. Unlike other structural materials, the strength of steel is not impaired by freezing, intense heat, or rain. Its qualities are immune to injury resulting from climatic conditions. It does not have to be warmed, protected, and kept moist in order to acquire or retain its strength. Structural steel needs no protective coverings or housings during erection.

Steel members have dropped from high elevations, or have been subjected to ship or train wrecks during transit, and yet have suffered no damage. Unless a member be visibly distorted it can be relied upon for its full duty. One pound of steel will do more work, resist more stress, and carry more load, than one pound of any other structural material. The relative strength of steel and other materials per pound of material is as follows:

Steel	100
Granite	79
Brick	79
Longleaf yellow pine	86
Concrete	10

Note. The above ratios are based on compressive strength. Steel and longleaf yellow pine have tensile strength equal to their compressive strength. Granite, brick, and concrete do not possess any appreciable tensile strength.

With steel, less column and weight of material is used, less tonnage transported, handled and erected. The building weighs less and lighter, less expensive foundations are needed. The performance of steel itself, its enduring strength and value, is evidenced by its recovery from old buildings to serve again as important parts in new framework. The value of structural steel depreciates but little through years and years of service. Steel mills and fabricating plants in the United States and Canada represent the investment of billions of dollars in buildings and equipment. These great industrial organizations, because of the colossal nature of their business and their tremendous investments must be responsible for uniform high quality, the most approved standards of manufacturing practice, and the proper design and application of their product.

Steel sheathing of the same inherent characteristics, in a multitude of shapes and sizes, is available for walls and roof, sheathing having milled contents of copper and other materials and surface treatment of galvanizing and the like that positively prohibit corrosion and guarantee an indefinite life. Positive weather proof joints have been devised, tested, and proved that, due to the fixed non-warping nature of the material used, are *always* weather tight. Wall and roof sections are attached easily and quickly. If we plan on heating our building the insulating material and the roof and wall sections can be attached in one operation. Engineers have granted such construction heating properties equivalent to an eight inch brick wall.

Doors, sash and ventilators, all of steel, find their place and stay in place. They operate easily at all times, their substance is fixed, they can not warp or get out of shape.

Our hangar is up—what do we find? A firm rugged building of fixed structural properties, non-inflammable, weather proof, lightning proof, a building that with even casual care will last a life time. A building whose characteristics have successfully withstood fires of both exterior and interior origin. A building that has been known successfully to withstand wind attacks up to velocities of 100 m p h.

We have a permanent structure if we want it so, and still one that we can salvage completely and re-erect on a new location with wrenches and screw drivers. After studying our problem from every angle we wonder if this isn't our logical solution in the interest of good Business Economy.

THE FUTURE OF THE *Schneider Trophy Contest*

By *Aviation's* British Correspondent

There is a certain amount of talk in Europe that the 1929 Schneider Trophy Contest will be the last, unless, of course, the United States of America awakes from her lethargy and forces the issue. It is true that Ramsay Macdonald, at the informal banquet which followed the race, said, in the first flush of victory, that Great Britain was prepared to defend the Trophy against all comers, and General Balbo made a very apt phrase when after congratulating the winners he said "for ourselves, our work as your competitors commences tomorrow," a statement taken to mean that Italy would not be caught unprepared in 1931.

But politicians' phrases are said for the hour, and there certainly was on the eve of the race a feeling that might be described as "trophy weariness" among the Royal Aero Club, which had had the burden of the organization among the Technical Departments of the Air Ministry, which had had the responsibility of fostering another national success, and, above all, among the aircraft designers who for two years had neglected almost all other creative work.

Whether the same feeling will persist six months later I cannot say. However, one prominent officer of the Royal Air Force certainly expressed the view that the Air Ministry had now done all that could be expected of it in the direction of giving the British aircraft industry a world wide advertisement and of proving that British technical skill was supreme when it bent its energies to one task. It is certain that the expense of preparing the machines, and the task of organizing the Contest in British waters crowded with shipping entails an enormous expenditure of time and money and the enlistment of an organization which is national in the true sense of the word.

Italy was very dissatisfied with the water conditions of the Solent, and the Royal Aero Club of Italy two days before the race actually addressed a formal complaint to the British club that the constant passage of shipping up and down Southampton Water and the large amount of floating wood and debris from the docks above at Southampton made the water quite unsuitable for practice, forgetting apparently that this was the only water the British pilots had had from the start. Italy frankly did not like the tide, the currents, and the roughened surface, and being used to the smooth conditions of Lake Garda it is understandable that her seaplanes might not be so happy in the turbulent seas.

The British victory was with seaplanes which not only attained the highest speeds yet known to man, but which also were thoroughly practical machines for open water. The Italians realized that to fly the little Fiat with its landing speed of 130 m p h was a physical impossibility in our waters. Complaint was made by Lieut Col Mario Bernasconi, the captain of the Italian team, that "there are many irksome conditions in the rules which make it impossible to put the fastest machines in the race. The machines have to pass so many tests which are irrelevant to their speed." This then looks like being the point on which some effort may be made to revise the rules of the Contest, and it is obvious that the Continental nations, happy in the possession of great sheets of inland water or with the relatively smooth waters of the Mediterranean, may easily be swayed toward the view that the Schneider Trophy should be a contest of shear speed and not of a well balanced and thoroughly seaworthy design of seaplane able to fly at high speed but with full control.

Great Britain, so far as I can gather, will, however, contend that the Trophy shall still retain a practical character in order to prevent freak machines being put in, and for this reason will insist upon the retention of a closed circuit and upon some form of navigability test. It was pointed out quite properly that given a straight course and no sea trials it would be quite possible to build a machine in which the pilot was more or less lying prone and in which he discarded his floats as soon as he got off the water, flew straight and blindly for the required distance, then stopped the engine, locked his airscrew horizontal and landed on the smooth under surface of the fuselage. Admittedly the risk to personal safety would be high, but there are many men who for national glory would accept the chance.

Yet how would such a victory advance the science of aeronautics? If this Trophy is to be kept alive it must be upon the basis that the international competition it engenders is good for the improvement of the breed of aircraft in every country in the world.

Great Britain, therefore, places great importance upon a closed circuit with turns as ensuring a seaplane which is reasonably controllable and is not entirely blind, but there is a feeling that the navigability and seaworthy trials might perhaps be modified on the lines of the regulations for the straight speed contest in which two alightings only on water are necessary. It is felt that the preliminary practice is a good enough test of the seaworthy qualities.

These questions may come up for consideration before the Federation Aeronautique Internationale between now and the period when preparations must be made for the next Contest. It would be very useful if the National Aeronautic Association of America gave some consideration to this aspect of the matter, for it would be a thousand pities if the glamour of sheer speed should obscure the more practical qualities of an aircraft.

Airwheels FOR AIRPLANES

Performance of the Large Capacity, Low Pressure Tires, Recently Developed for Airplane Use

By A. J. MUSSELMAN
The Goodyear Tire & Rubber Co

EXHAUSTIVE FLYING and laboratory tests of huge air capacity low pressure airplane tires have now been made as an incident to the development of this type, known as the Goodyear Airwheel.

The specific data that follow regarding the Airwheel have all been taken from either actual flying and landing tests or reliable laboratory tests and indicate the advantages of the Airwheel.

The outstanding advantages are Extreme cushioning in landing and taxiing; safe landing in sand, soft ground, wet fields, snow or rutty fields more perfect stream line shape; quicker take-offs and shorter landings; elimination of shock absorbers; less wear and tear on plane no wheels to collapse; safety when landing with a punctured tire; less weight with added strength; internal hub brakes; slower and shorter kick-backs when landing, and greater safety in forced landing.

Extreme Cushioning in Landing and Taxiing—is accounted for by the huge volume of air at low pressure which allows a long deflection under impact and the building up of higher internal pressure as deflection occurs.

This building up occurs over a much longer period than is possible in a high-pressure tire. The lower the pressure the slower will be the absorption of impact and the higher the percentage of increase in pressure. Wright Field tests, as well as the writer's own, show that this pressure will build up from an initial value of 10 lb to a final of 18 lb in a heavy landing, whereas in the average high pressure tire the initial pressure of 50 lb will rise only to 55 lb.

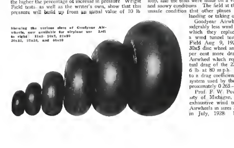
With both light and heavy planes landings have been made many times on very rough fields and very soft wet fields, with no perceptible jar. The very wide tread of the Airwheel with its low air pressure produces a soft yielding foundation of great width, making it possible to land in many places where it would be impossible to do so with narrow high pressure tires without injury to the plane.

EARLY THIS YEAR B. E. (Shorty) Fulton manager Municipal Airport, Akron, Ohio, experimented with a Waco plane fitted with 22x10 Airwheels. These Airwheels were first inflated at 10 lb pressure, then one Airwheel was deflated to 7½ lb, 5 lb, 2½ lb and with no pressure respectively. The machine was tested at these various pressures and at no pressure.

The machine was landed, jumped, taxied, run through soft and muddy ground, shallow ditches. In no case could the pilot detect a difference in the two Airwheels in the handling of the plane except at complete deflation, and then only after the plane was fully landed and was taxiing. There was no tendency for the plane to ground loop, and the tests were made on a variety of soft, rutty and snowy conditions. The field at the time was in such unsafe condition that other planes would not attempt landing or taking off.

Goodyear Airwheels produce considerably less wind drag than the tires which they replace. For example, a wind tunnel test made at Wright Field Aug 9, 1929, showed that a 30x5 disc wheel and tire produced 33 per cent more drag than the 22x10 Airwheel which replaced it. The actual drag of the 22x10 Airwheel was 6 lb at 80 m.p.h. [This corresponds to a drag coefficient on the "absolute" system used by the N.A.C.A., of approximately 0.265.—Ed.]

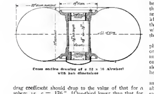
Prof. F. W. Powlowski of University of Michigan, Ann Arbor made exhaustive wind tunnel tests of two Airwheels in sizes 31x16¼ and 20x10½ in July, 1928. His report states:



Showing the various sizes of Goodyear Airwheels, now available for airplane use. Left to right: 15x5, 10x7, 22x10, 30x13, 37x14, and 46x19

A set of 37x10 Airwheels fitted to a Wasp powered Fokker Super Universal

"It stands to reason that the drag coefficient of a wheel depends upon the diameter-thickness ratio of the tire. The smaller the value of that ratio (the fatter the wheel or tire) the smaller should be the drag coefficient as in the extreme (hypothetical) case when the ratio becomes equal to unity, the wheel would become a sphere and the



Cross section drawing of a 22 x 10 Airwheel with hub dimensions

drag coefficient should drop to the value of that for a sphere, i.e., c = .176." [One-third lower than that for the Airwheel in the Wright Field test.—Ed.]

In the past 60 days many actual flying tests have been made with these fat tires against the sizes they replace as well as other sizes, and in every case the inferences from the wind tunnel test have been confirmed. These tests were all made by plane factory pilots accurately clocked and verified by repeated tests. So the often-asked question regarding drag can be answered: Airwheels have less drag than the tires they are to replace.

On all ordinary landing fields or especially soft wet and sandy ground the Airwheels have a quicker take-off provided the proper low inflation pressure is used. (See Table I). With this low pressure the machine under static load will deflect the tires from 2 to 5 in. depending on the size of the tires and weight of machine, the heavier the machine the greater the deflection should be in inches. Under this condition the quicker take off results.

This is accounted for by the fact that when the plane's engine is accelerated, lifting action sets in immediately on the wings and the lifting action begins to take the deflection out of the Airwheels. The action is so pronounced that when a machine is held and the engine materially accelerated, practically all deflection will disappear.

The effect of this force on the Airwheels is to allow the machine to rise gradually from the ground from 2 to 5 in. depending on size of tire, and still be in contact with the ground. Under this condition, it will readily be seen that any obstacles or uneven place in the path of the Airwheels will more readily sink into the Airwheels and the loading machine can move forward with less lifting or jumping over obstruction than in the case of the higher pressure type tire and thus eliminate the loss which occurs every time the plane bounces or raises off the ground during the take-off run.

In landing naturally the reverse occurs. When the plane touches the ground the engine is throttled down or cut and the streamline blast dies down. Deflection immediately takes place in the tires, producing a broad contact, a sort of web-foot effect, thereby tending to slow the machine more quickly and at the same time help hold it on a straight line.

If the proper size Airwheels are used at proper low air pressures, it is the writer's belief that auxiliary shock absorbers can be done away with. This will not only save weight and cost but will eliminate the necessity of building the various swivels, joints and loose connections necessary where shock absorbers are used. More satisfactory results are obtained than with any shock absorber so far tested, since shock absorbers do not get into action until the impact has built up a considerable force, and therefore do not appreciably soften the impacts of ordinary landings. The low pressure Airwheel absorbs the light shocks as well as the severe ones, softening down all kinds of landing shocks in the most perfect manner.

DROP TESTS have been made in accordance with Department of Commerce requirements, which have proved this point. The huge air capacity and low pressure allow a long, slow deflection and a minimum amount of back-kick. This back-kick or rebound is vastly less sharp than with present wheels, tires and shock absorbers.

The building up of air pressure under impact gives an effective shock absorption in stopping or catching the impact that can hardly be equalled by any other method.

Using low air pressure Airwheels naturally converts them into slow acting air cushions. The result is ex-

tremely slow deflection and slow kick-back unobtainable in high pressure tires In landing, the effect is a long wave motion so soft that the feeling to the pilot is the same as if he were still in the air riding through warm and cold air currents In fact, it is very hard for him

TABLE I

Suggested sizes and pressures for present weight ships

Weight of Ship	Airwheel Sizes	Pressures	Optional Size Airwheel Size	Pressure
16,000	46x20	21		
14,000	46x20	18		
12,000	46x20	15		
10,000	46x20	12	Or 32x16	19
8,000	37x16	14½		
6,000	37x16	10	30x13	12
5,000	37x16	7½	30x13	14
4000	37x16	5½	30x13	10½
3,000	30x13	7½	22x10	18
2,750	30x13	6½	22x10	16½
2,500	30x13	6	22x10	15
2,250	22x10	13		
2,000	22x10	11½		
1,800	22x10	10½		
1,700	22x10	10		
1,600	22x10	9		
1,500	22x10	8½	–	
1,400	22x10	7½		
1,200	22x10	7	–	–
1,000	22x10	6		
Tail Wheels Weight				
1,500	22x10	15		
1,000	22x10	11½	–	
750	22x10	8		
600	16x7	12		–
500	16x7	8		
200	12x5	6		

to tell exactly when he comes in contact with the earth in landing This softness of landing naturally saves the wracking and wrenching of the plane thereby lengthening its life

The danger that exists of the collapsing of the ordinary plane wheel does not exist with the Airwheel, as no regular wheel is used The unusually wide hub width gives a wide foundation for the tire. The hub is further provided with deep corrugations to fit corresponding corrugations in the base of the beads of the tire thus preventing the tire from crawling In effect, the tire and hub are the wheel in one

The landing of a plane fitted with Airwheels at no air pressure has been tested and presents less danger than with the ordinary high pressure tire and wheel As an example a 22x10 Airwheel, with its recommended load and inflation pressure, holds the axle on which it is mounted 8.3 in from the ground If the tire goes flat the axle will be lowered to 4.4 in, or a drop of 3.9 in When the 30x5 high pressure tire comparable to the 22x10 in capacity and rating, goes flat, it lowers the axle 2.4 in The differential between the two tires is only 1.5 in

This difference is more than offset by the wide base of the tire, also the fact that *even without pressure* (at the instant of impact), the atmospheric pressure in a 22x10 Airwheel is raised to a value great enough to support a load of over 550 lb The sudden building up of pressure of the large volume of air remaining in the Airwheel takes care of initial shock of landing Further, the tires are built with straight side beads, with steel wire rings, and can never be made to jump from the hub and become entangled in the landing gear to cause ground looping

These Airwheels will weigh considerably less than the corresponding tire tube and wheels they replace From the standpoint of impact, it is doubtful if it would be possible to injure the Airwheel Not only do laboratory impact records confirm this, but actual landings under unusual conditions.

The Airwheel is made to fit on a special hub This hub is constructed to take an internal expanding brake This brake mechanism hidden from view in the hub makes the complete tire, wheel and brakes as near streamline as possible

As a basis of comparison of the kick-back action compare the 22x10 Airwheel with a 30x5 the size it replaces On a plane of approximately 2000 lb total loaded weight, the air pressure in the 30x5 should be 32 lb. to the square inch with the 22x10, 11 lb. is sufficient. With this low pressure, naturally an ideal cushion is created during the landing impact, and permits, if necessary, a maximum deflection of over 6 in, whereas the deflection of the 30x5 cannot be more than 3½ in. Moreover, the rebound or kick-back of the high pressure tire is much more sudden and therefore much more severe

This extraordinary difference in favor of the Airwheel may be still better understood by considering the time element factor That is, the difference in length of time of the impact period between the Airwheel and the higher pressure tires In addition, the low pressure of the Airwheel with its huge air capacity, not only lengthens the time between impacts, but the compressional energy in foot-pounds is 60 per cent more than in the 30x5 All in all the Airwheel produces a long, slow deflection, a shorter rebound making a low smooth trajectory movement in landing In cases of forced landings the Airwheel will normally land a plane safely where it would be

A set of Goodyear Airwheels fitted to a Fleet biplane

practically impossible with high pressure tires without injury to the plane

These tires are made at present in six different sizes Front wheel sizes are 22x10, 30x13, 37x16, 46x20 Tail wheels, 12x5, 16x7, 22x10 These sizes take care of practically any weight plane made at the present time When larger planes are made Airwheels can be made to accommodate them

LOOKING FOR *Safer Aircraft*

The Guggenheim Safety Competition Draws Near to Its Close

The Handley Page entry demonstrating control in the stall. Both automatic and manually operated slots are open and the manually controlled trailing edge flap is pulled down for attaining minimum speed

THE LAST DAY of the present month marks the beginning of the last stage of the Daniel Guggenheim Safe Aircraft Competition, formally launched by Harry F Guggenheim at a meeting in New York on April 30, 1927 To be eligible for consideration all competing machines must have been presented for tests at Mitchel Field by October 31, although it is to be anticipated that the tests will run on for a number of days thereafter, and that the final announcement of results will have to be correspondingly delayed.

There has been received a total of almost 30 entries in the competition Two were withdrawn at a very early stage, when the companies making them found that it would be impossible to steal from their other activities the necessary time for constructing a special machine for the contest Two more planes were presented at the Field and then removed, and there remains a total of 23 entries on the active list, nineteen of them being American, three British, and one Italian. Only two of that number have actually appeared for tests up to October 8, while several more are known to be nearing readiness for test While there will undoubtedly be a great rush of competitors in the closing days of the month, the presumption is strong that a number of the entrants never will appear

The object of the competition, as explicitly defined in the Guggenheim Fund's announcement, has been the encouragement of work for aerodynamic safety There was no attempt in preparing the rules to encourage structural novelty, or the provision of special safeguards against fire, or any of the other possible contributions to safety through design The rules were drawn to insure that the winning airplane would be safely controllable under all conditions, that it would have a high degree of inherent stability, and that its landing speed would be so low as to minimize the danger of injury to the machine or its occupants on contact with the ground. The most severe of the composite qualifying tests, involving both landing speed and control, requires that every machine must demonstrate its ability to take off from and climb out of a field 500 ft square, bordered by trees 25 ft. high, and that the pilot must be able to make a safe landing within the field in case of engine failure at any instant during the climb

The Alfaro entry with flaps in landing and minimum-speed setting

To protect the competition against the production of pure freaks, the rules bearing directly upon stability, control, gliding angle, and minimum speed were supplemented by requirements that the performance should be reasonably good in all respects Specifically, each aircraft is required to carry 5 lb of useful load per horsepower, including fuel for three hours

flying at full throttle to make a maximum speed of 110 m p h ; and to climb 400 ft per min at a height of 1,000 ft above sea level.

THE RULES of the competition invited, but did not definitely require, a type of aircraft radically departing from the normal in appearance and function. The specification of a minimum speed of not more than 35 m p h in level flight made it impossible to use a wing loading of more than about 5 lb per sq ft, if a standard airplane were to be entered. If the machine were to be so standard that it included no slots or flaps or other provisions for varying the lift of the wing, the load could have hardly exceeded 4 lb per sq ft. To combine the minimum speed with a maximum of at least 110 m p h, the power loading would have to be kept in the neighborhood of 8 or 9 lb per hp with a variable camber wing, and but little over 6 lb without means of varying the lift. Stability would have to be excellent, and the machine would have to be spin-proof and possess a very rugged landing gear to permit of pancaking down out of a steep glide. Given those unusual characteristics, a machine of standard type ought at least to meet the standard of minimum qualification.

There is no way of knowing how many of the entrants yet to come may have decided novelties to present, but at least two autogiros are included in the list. The first four machines to appear, including the two subsequently withdrawn, all adhered closely to standard practice except for the use of flaps and slots.

The first plane to come up for test was the Brunner-Winkle entry which was first submitted early in July, and has been flown intermittently ever since. The plane follows the firm's standard design closely and has no variable lift mechanism securing a reduced minimum speed only by the increase of area. A number of speed trials have been made interspersed with minor adjustments and modifications. It appears from experience so far had with all the competing planes and from predictions of what types not yet submitted for test may be expected to do that the maximum speed requirement, put in to the rules originally as a general requirement not needing to be especially stressed, is to offer one of the most troublesome problems. The minimum speed requirement would be easy to meet if there were no specification of maximum although in that case the demand in the rules that the plane shall be able to be taxied in any direction without external assistance in a 20-mile wind would be likely to offer serious difficulty for a plane of abnormally low wing loading and with no means of varying the lift.

THE MACHINE built and entered by Heracho Alfaro of Cleveland second to arrive upon the scene of action, was given preliminary tests during September, and was withdrawn by the builder when he satisfied himself that certain of the tests were beyond the range of his machine in its present form. The design remains interesting as showing one engineer's reaction to the rules.

The Alfaro plane illustrated herewith, is a cabin monoplane with a variable lift wing. The construction is standard except in respect of the variable-lift device, which includes provision both for change of wing section and change of area. The Alfaro flap as shown in the photographs, pulls down along the trailing edge, and at the same time moves backward from the hinge, carrying a shutter with it so that no open gap is left and so that the trailing edge is moved backward appreciably from its normal position with the flap raised. Wind tunnel tests are reported to have shown an increase of lift of about 87 per cent in a Clark Y section by the use of such a flap.

Lateral control in the Alfaro design was secured by a combination of ailerons set at a very heavy angle of skew to the span, as can be seen in the illustration, and spoilers or small auxiliary surfaces above the leading edge raised to destroy the lift on the side of the plane which the pilot wishes to lower. The standard aileron control is especially effective at low angles of attack, while the spoilers come into effective action under stalled conditions.

One other minor departure from conventional form in the Alfaro design was the placing of the horizontal tail surfaces high above the fuselage in the endeavor to decrease the amount of interference with the air-flow over the tail and reduce the downwash and slipstream effects.

The third of the machines entered that arrived at Mitchel Field was a standard slotted Moth, but that also was withdrawn before having officially been put through any of the tests.

The next and the first of the foreign competitors was a plane constructed by the Handley-Page Company, now awaiting trial.

IT IS IMPOSSIBLE as yet to give out any characteristics either on the details of design or on the performance of the Handley-Page machine, but in its general appearance there is nothing of the bizarre. It is a biplane with the lower wing smaller than the upper, and with slots and flaps both for lateral control and for the increase of maximum lift. The auxiliary airfoil which forms the slot near to the tips of the upper wing and in front of the ailerons, which are mounted on the upper wings alone, operates automatically in accordance with the conventional present practice for slot control. It is thus impossible inadvertently to get the machine into the stalled attitude with the slots still closed in front of the ailerons. Over the remaining parts of the upper wing, however, and over the entire lower span, the slot is manually controlled by the pilot and a flap along the trailing edge operates in conjunction with the auxiliary airfoil, the flap coming down as the slot is opened. This is of course in accord with the general development of Handley-Page design practice over the past several years.

As previously mentioned, no figures are being given out on the plane, but the construction appears to be light, and the wing loading is understood to be of the order of 5 lb per sq ft. The landing gear has the appearance of great solidity and unusually long shock-absorber travel. The machine has been extensively tested in England before it was brought to this country, and will be flown in its preliminary demonstrations at Mitchel Field by Captain Cord, representing the Handley-Page Company. The rules of the competition restrict the entrant's pilot to carrying out demonstration flights to show that the machine can be put through the tests with safety. The actual test flights and observations will be made by the Guggenheim Fund's pilots, Thomas Carroll formerly test pilot for the National Advisory Committee for Aeronautics, E W Rounds of the Bureau of Aeronautics of the Navy Department, and Lieut. Stanley Umstead of the Air Corps. They have a very large amount of test flying ahead of them in the next month.

GENERAL NEWS

Nine States Without License Requirements

WASHINGTON (D C.) — Federal licenses are now required for all airplanes and aviators by nineteen states and one territory, figures released by Clarence M. Young, Assistant Secretary of Commerce for Aeronautics show Of the 52 states, districts and possessions of the United States, ten states require Federal licenses for craft and pilots engaged in commercial flying, either state or federal licensing is necessary in six states, six require states licenses, and nine states require none at all.

Alaska, Arizona, California, Delaware, Idaho, Indiana, Iowa, Michigan, Mississippi, Missouri (except soloing for pleasure), Montana Nebraska New Mexico, North Dakota, Rhode Island South Dakota, Texas, Vermont, Washington, Wisconsin and Wyoming are the states where Federal licenses must be secured

Federal licenses are imperative for commercial flying in the following localities Colorado District of Columbia Hawaii, Illinois New Jersey, New York, North Carolina Ohio, Philippine Islands, and West Virginia An option of either a Federal or state license is made in Maine Maryland Minnesota, New Hampshire Oregon and Virginia, while the states requiring state licenses for all planes and operators are Arkansas, Connecticut, Florida, Kansas, Massachusetts, and Pennsylvania

Alabama, Georgia Kentucky Louisiana, Nevada, Oklahoma South Carolina, Tennessee, and Utah are without state or Federal license requirements

Preparation is under way by the Aeronautics Branch of a pamphlet containing information on state aeronautical legislation, with abstracts and verbatim copies of all regulatory state laws pertaining to aviation Abstracts of the 1926 Air Commerce Act will also be furnished and suggestions for uniform state air laws offered

Engine and Propeller Approvals

WASHINGTON (D C.)—Recent approvals of engines and propellers bring the former to a total of 30 and the latter to a total of 111, according to the Oct 1 Air Commerce Bulletin New power plant approvals are No 28—Pratt & Whitney Hornet, 9 cyl radial air 575 hp at 1,950 revolutions No 29—Pratt & Whitney Hornet, 9 cyl radial air, 500/1900 and No 30—American Cirrus, 4 cyl in-line air 90/2100 Approvals No. 89 and No 90 in the propeller list are the Jacuzzi, No 3 and the Flottorp Standard OX-5, respectively Nos 91 through 111 are Standard Steel Propeller firm makes

Livingston Keeps Tour Lead As Planes Arrive at Atlanta

Stage St. Louis Show Feb. 15-23

ST. LOUIS (MO) — This city will be the scene of the International Class "A" Aircraft Show which is to be held from Feb 15 to 23 inclusive These dates have been announced by the Aeronautical Chamber of Commerce under whose auspices the exhibition is held Permanent exposition buildings, adjacent to the airport will house the exhibits, enabling planes to be wheeled in from the landing field without being dismantled

Desoutter Rights to U. S. Firm

NEW YORK (N. Y.)—Manufacturing rights for the United States and Canada of Desoutter aircraft has been disposed of to Gorodon England Company of America Inc. Hudson, N Y, according to advices from Desoutter Aircraft Company Ltd, Croydon Aerodrome, London S W

Many Attend Legion Air Show at Louisville

LOUISVILLE (KY) — More than thirty thousand persons viewed the air circus held here during the national convention of the American Legion The air show was at Bowman Field, the municipal airport in Seneca Park

Besides the civilian flyers headed by Freddie Lund chief test pilot for Waco Aircraft Corporation, there were detachments from the Army, Navy and Marine Corps flying units War-like maneuvers such as ground straffing dog fighting, smoke screen demonstrations, and attack of ground troops were performed by the service pilots

A unique feature of the circus was the night exhibition flying of Lieut McCallum of the Reserve Corps In this flying Lieut McCallum set off a blazing trail of fireworks that made him plainly visible against the sky

Captain E F Galloway commandant of the military post at Bowman Field, radiocast all the events and explained the various maneuvers during each afternoon of the air show

Scores 22,836 Points In J-6 Waco; Davis Next

By JOHN T. NEVILL
WITH THE NATIONAL AIR TOUR

ATLANTA (GA.) — Having covered a total of 2,575 mi, or a little more than half of the 5,017 mi scheduled, John Livingston, flying a Waco biplane powered with a Wright J-6 225 hp engine was continuing to increase his lead over 27 remaining contestants for the Edsel B Ford Reliability Trophy when the National Air Tour landed on Candler Field, here, Saturday, Oct. 12

Livingston has the highest "figure of merit" of any contestant in the Tour, with his standing 135 84 points in excess of his closest competitor He knew before starting that if he kept to schedule throughout the journey, he could not fail to win By flying every one of the sixteen legs thus far covered well within the allotted time assigned him—a time based upon an average speed of 85 per cent of the maximum speed shown by his plane in the tests made at Ford Airport before the start—Livingston's total number of points now is 22 836 or 2 390 points ahead of the second plane, a similar Waco flown by Arthur J Davis Mr Davis fell behind his schedule and lost points on the leg between Portland Me and Springfield, Mass, the stretch on which head winds were encountered similarly troublesome to many of the other contestants The Davis score at Atlanta was 20 446 with the remainder of the field as follows

Plane	Pilot	No. of Points
Ford	Zeller	19 276
Fairchild	Hackman	19 130
Bellanca	Haldeman	16,717
Curtiss Condor	Croswell	16 184
Bellanca	Nagle	15 768
Command Aire.	Cone.	14,766
Fairchild	Miller	14,422
Ford	Warner	13 857
Curtiss Thrush	Jackson	13 849
Cessna.	Lacey	13 784
Cessna	Stanton	13 642
Spartan	Welboen	11 775
Great Lakes Trainer	Meyers	11 500
Curtiss Thrush	McGrady	11 386
Fairchild	Pearn.	11 373
Ryan	Wright	10 741
Lockheed	Post.	10 418
Curtiss Robin.	O Brine	10 292
Gypsy Moth	Krapish	9 814
Boeing	Wagner	9 650
Curtiss Robin.	Shelton	9 555
Gypsy Moth	Harrell	8 760
American Eagle	Haslop	8,350
Travel Air	Harrod	7 401
Great Lakes Trainer	Lancaster	7 315

Head winds and other unfavorable weather, difficult flying country and the rule requiring pilots to maintain at least 85 per cent of their maximum

(Concluded on Next Page)

Livingston Keeps Tour Lead at Atlanta, Ga.

(Concluded from page 797)

speed have combined to produce a total of 448 plane-legs, 28 planes over sixteen legs each at this juncture Only five contestants, in fact, have maintained perfect scores thus far, the select group including the Bellanca flown by George Haldeman, the Curtiss Thrush, piloted by Dale Jackson, the Curtiss Robin with W Gentry Shelton in charge, Forest O'Brine's Robin, and John Livingston's Waco. Those having had only one late arrival at a control point are Charles W. Meyers, flying an American Cirrus-powered Great Lakes Trainer, Arthur Davis in a Waco, Reuben Wagner in a Hornet-engined Boeing 95, Wiley Post in a Lockheed, Wasp-powered, Steve Lacey with a J 6 Cessna monoplane and R. W. Pears in a Wasp-powered Fairchild "71"

Only one entry has definitely dropped out of the contest since the original 29 planes took off from Ford Airport, that being a Wallace Touroplane piloted by Don Mather. Mather's engine died while he was taking off from Logan Field, Baltimore necessitating a forced landing in which the craft's landing gear was smashed so badly that the plane was withdrawn from the Tour There have also been several additional minor mishaps but none to cause more than a day's delay in catching up with the others Henry Poindexter is now flying one of the Cessnas Earl Rowland, its original pilot having become suddenly ill at Richmond

Head Toward Mid-West

Up to this time the 28 entries still in the contest have visited Toronto, Ottawa, Montreal, Portland Springfield New York City Philadelphia Baltimore, Richmond, Winston-Salem N C Greenville, S C Augusta Ga, Jacksonville Fla, and Macon, Ga. Over this route weather conditions while for the most part fair, have been such in spots that in two instances scheduled departure of planes has been delayed a few minutes on advice of C. G. Andrus, Government weather expert assigned to the Tour

From Atlanta the competing planes and the ten or more official and accompanying craft will head toward the Mid-West via Cincinnati and Louisville From their farthest point west at Wichita the route will carry them northward to St Paul from where the return to Detroit will be begun to end on the afternoon of Oct. 21

Try F. & J. Engine in Travel Air

PHILADELPHIA (PA)—Al Jacobs, engineer of this city, arrived in town Monday with the Travel Air in which the new Fischer and Jacobs engine was recently mounted at the Travel Air factory in Wichita. The new engine, recently approved by the Department of Commerce, will be put into production at once.

Teaches "Landings" on Smoke

NEW YORK (N Y) — A novel method of teaching students to land is being tried at Holmes Airport, Queensborough, by the Gates Air Service. A smoke bomb is dropped from the training plane to explode while still far above the field. The student is then instructed to make a simulated landing on the floor of the resulting smoke, a poor "landing" high in the air resulting in no ill effects

Curtiss-Wright Sales Firm Headed by Beech

NEW YORK (N Y)—Walter H. Beech, president of Travel Air Manufacturing Company, has been named president of a new sales company which will be owned by what was formerly known as the Curtiss Flying Service now entitled the Curtiss Wright Flying Service following a vote of the board of directors Another of Mr Beech's offices will be the position of chairman of the sales committee of Curtiss-Wright Corporation.

Election of the following additional Curtiss Wright Corporation officers was announced after the Oct 8 meeting of the board Executive vice-president J. A. B. Smith former secretary and treasurer of Curtiss Aeroplane & Motor Company vice-president Walter H. Beech, also named to the positions mentioned above, and treasurer, J F Prince, treasurer of Wright Aeronautical Corporation

The airport section of Curtiss-Wright is led by William F. Carey president of New York Air Terminals Inc. Walter S Marvin, formerly holding this position as president of Curtiss Airports Corporation is now chairman of the board

More Capital for Allied Motors

NEW YORK (N Y)—Until Nov 8, preferred and common stockholders of Allied Motor Industries, Inc., will have the privilege of subscribing to one new share of common stock for each five shares now held at $31.50 per share Approximately $1 500 000 will be added to the company's working capital by this plan. Allied Motor Industries recently gained control of the American Aeronautical Corporation which has the rights in this country for the manufacture and sale of Savoia-Marchetti seaplanes and amphibions.

Inspector Added in Northwest

PORTLAND (ORE)—Because of the great increase in aviation activity in the Pacific Northwest the inspection work for the Department of Commerce has now been assigned to two men. Formerly one inspector was assigned to cover Oregon and Washington with headquarters in Seattle Now Frank Knight has been transferred from Los Angeles to cover the Washington territory with Seattle as headquarters. Wilbur B Wright will remain in Portland to cover Oregon

Yellow Firm Contracts For 200 Buckley Planes

WICHITA (KAN)—Officials of the Yellow Air Cab Company and the Buckley Aircraft Company, both with headquarters in Wichita, announce the closing of a contract by which the Buckley firm will build 200 airplanes at a value of $2,225,000 for Yellow Air Cab The Buckley firm builds a low wing all-metal plane carrying three passengers and pilot

Work has started on one of two big factory buildings on the Buckley 120-acre airport east of Wichita. The first structure, 64 x 100 ft, will be completed within 30 days according to Roy B Buckley, president of the aircraft company and the second, 75 by 600 ft. will be occupied by Jan 1

Gary E. Prebensen, president of Yellow Air Cab, says his firm will absorb the entire output of the Buckley firm for the year ending June 1, 1931 The Buckley plane will carry Wright power of 225 hp The wingspread of the original Buckley all-metal plane will be increased to 52 ft

As the Yellow Air Cab Company plans to inaugurate its nation-wide service shortly, other types of planes will be used until the Buckley contract is filled

William B. Stout Detroit aircraft engineer and designer is consulting engineer of the Buckley firm though he has no financial interest in the company

Assistant Director

CAPT. GILBERT G BUDWIG has taken the position of Assistant Director of Aeronautics the appointment being necessitated by the large increase in licensing work, according to Assistant Secretary of Commerce Clarence M Young who announced the new office Captain Budwig has been Chief of Inspection of the Air Regulations Division

Kinner Has Shipped 783 Engines This Year

GLENDALE (CALIF)—In a recent letter sent out to its 3,519 stockholders, Kinner Airplane & Motor Corporation outlines its progress and development since construction of the first Kinner engine in 1921. Commercial production of the engine did not start for several years, as the first one, which was of a three cylinder, radial air-cooled type, lacked sufficient horsepower and vibrated excessively

Incorporated under the laws of California in 1919, with an authorized capital stock of 100,000 shares of $1 par value each, the stock was increased in 1928 to 600 000 shares and in May of this year to 2 100 000 shares, of which shares outstanding now number 1 946-159. At present, 35 airplane manufacturers are using Kinner engines

The Kinner power plant was issued Approved Type Certificate No 3 after it had passed a 50-hr test. So far this year, 783 engines have been shipped from the plant, located here. Present factory facilities provide 39,250 sq ft of floor space Branch service depots have been established at Wichita Kan, Havelock Neb, and Buffalo and Hempstead, N. Y. The Grand Central Airport here has several hangars for housing Kinner test and demonstration planes

Enclosed with the letter on the company's history was the August balance sheet, showing the total net worth of the company to be $1,969 568.10 and total liabilities and net worth to be $2,330,639.72

Six Plane Approvals Issued

WASHINGTON (D C.)—Department of Commerce approved type certificates were issued to six plans during the week ending Oct 12 Listed according to certificate number, make and designation, type, power plant useful load, and gross weight, they are as follows: No 248 Ireland N2C, five-place open amphibion biplane, Pratt and Whitney Wasp 450 hp, 1,566 lb 4 860 lb ; No 249-Mono-Aircraft Monosport 1, two-place closed monoplane, Warner 110 hp, 595 lb., 1,650 lb No 250-Mono-Aircraft Monosport 2, two-placed closed monoplane Kinner 90 hp 597 lb. 1,650 lb ; No 251-Stearman C3R three-place open biplane Wright 225 hp 959 lb 2,700 lb ; No 252-Lockheed Vega, seven-place closed monoplane Wright 300 hp 1,915 lb, 4,220 lb No 253-Swallow TPW two-place open biplane, Warner 110 hp, 538 lb, 1,739 lb

Gar Wood Buys Fokker F-11

NEW YORK (N Y)—Gar Wood, world's water speed champion, recently purchased a Fokker F-11 amphibion which he flew to Detroit from here after bringing the plane from the factory at Hasbrouck Heights N J Accompanying him on the initial flight of the seven-place cabin plane was his wife and two guests

Memphis Firms Merge

MEMPHIS (TENN)—Consolidation is reported here of Valley Air Lines Inc, and Tri-State Airways, Inc., under the name of Southern Aviation and Transport Corp which will be the distributor of Stinson Eaglerock, and Travel Air Planes The combined school resulting now totals 75 students. Frank E Bruce is president of the new firm.

Curtiss 1929 Exports Reach $2,125,000 Total

NEW YORK (N Y)—The Curtiss Aeroplane and Export Company reports orders for planes engines, and parts since the first of January, valued at $2 125,000 This amounts to more than 57 per cent of the total exports of these products for 1928, which were valued at $3,664 723

The 1929 figure includes engines valued at approximately $300,000, parts valued at $360,000 and fully equipped planes valued at $1,425 000 John S Allard, vice president of the Curtiss Aeroplane & Export Company declares the "scope and extent of foreign demand for American-made airplanes and engines since the first of the year has been a surprise, even to those of us who are closely in touch with the situation.

"In addition to these orders actually filled and placed, large contracts now under negotiation would indicate that the total volume of foreign demand during the current year is far beyond any point we anticipated. The whole situation constitutes a real tribute to the effectiveness with which American engineering and manufacturing resources have met the unusually exacting demands of aviation as conducted in other countries"

Form Air Associates Subsidiary

NEW YORK (N Y)—Air Associates Inc has formed a subsidiary of the same name which has been incorporated under the laws of Delaware and will be licensed in Illinois The new company will operate at the Municipal Airport, Chicago, taking over the assets and operations of the older division at Chicago. Officials are James B Taylor Jr, president F L Hill, vice president and Haven B Page treasurer The firm will start with a capital of $5 000 and a $95 000 surplus Directors of the company will be announced later

Plan Air Carnival at Omaha

OMAHA (NEB.)—An air carnival will be held here in connection with a jubilee observing the diamond anniversary of the state Nov 5-7 Col. Amos Thomas has been named chairman of the aviation committee, while Walter R. Johnson captain of the Army Air Corps Reserve will aid in arrangements. Display flying airplane races balloon bursting contests and other special events, will be staged

Name Van Orman Balloon Race Victor

Credited With 3-Mile Lead Over Capt. Kepner

WASHINGTON (D C.)—Ward T Van Orman, who piloted the balloon "Goodyear VIII," was judged winner of the 1929 Gordon Bennett Balloon Race held from St Louis Sept 28 in an official announcement issued here Oct 8 by the Contest Committee of the N A A Distances were scaled by the U S Geological Survey, giving Van Orman's distance as 341 mi —a victory of but 3 mi over Captain Kepner in the Army entry officially given a distance of 338 mi

With the U S Navy balloon third the United States entries turned in a clean sweep of the first three places the Belgian Danish, French German and Argentine entries trailing behind. According to place balloon country, pilot and aide, landing place, and distance in miles, the official results are reported as follows

First, "Goodyear VIII," United States, Ward T Van Orman, Alan MacCracken, 3 mi. S E Troy, Ohio, 341 mi

Second, Army, United States, Capt. W E Kepner, Capt J F Powell, 2 mi N Neptune, Ohio, 338 mi

Third, Navy United States, Lieut T G W Settle Ensign W Bushnell 10 mi S W Eaton, Ohio 304 mi.

Fourth "Belgica" Belgium, Ernest Demuyter Franz Lecharlier, Corydon Ind, 226 mi

Fifth, "Danmark," Denmark, Georg Schenstrom, S A U Rasmussen, 5 mi S E. Bedford, Ind, 209 mi.

Sixth, "Lafayette," France Georges Blanchet Howard A Scholle, Stinesville, Ind, 200 mi

Seventh, "Barmen," Germany, Hugo Kaulen, Jr., Fritz Ebener, 4 mi S E Melvin Ill 171 mi

Eighth, "Essen Stadt," Germany Eric Leimkugel, George Froebel Catlin Ill 169 mi

Ninth "Argentina" Argentine D Edouardo Bradley Francisco J Cadaval Fairbanks, Ind, 155 mi

Baltimore Show in December

BALTIMORE (MD.) — The First Annual Baltimore Aircraft Show sponsored by the Flying Club of Baltimore, is scheduled here at the Fifth Regiment Armory Dec 9-14 1929 Ray Krimm, who will be remembered as director of the Pittsburgh show in March, has been named show director He may be addressed here at the Lord Baltimore Hotel

Western Show Nov. 9-16

Did your last copy of AVIATION say the Western Aircraft Show was in October? A few of the first-run copies incorrectly carried this information. The exposition, of course, is scheduled Nov 9-16

Russians at Seattle On Moscow-N. Y. Flight

SEATTLE (WASH.)—"Land of the Soviets," the Russian plane which has been battling bad weather a great part of the time since it left Moscow on Aug 23, has arrived here at Sand Point Navy Air Field, Lake Washington, its first stop in the United States. Its journey to New York will continue by way of San Francisco and Chicago.

Officials of the city greeted the plane which landed at dusk on its journey of approximately 645 mi from Waterfall, Alaska, where it was forced down over a week ago and repaired by the installation of a new engine which was shipped from here. The craft, which is in charge of first pilot, S A Shestakov second pilot, Philip E Bolotov, navigator Boris V Sterlingov, and mechanic Dimitri V Fufaev, will not leave here until landing gear has replaced the pontoons.

Among those in the plane escort which heralded the Russians' arrival were Lieut-Comdr John D Price, commandant at Sand Point, and three officials of the Amtorg Trading Company, A V Petroff vice-president, L C Gershevitch, and B Belsky, Seattle representative of the firm. V M Petlyakov, aeronautical engineer, will accompany "Land of the Soviets" on its trip to New York

Halley Headquarters Established at Omaha

OMAHA (NEB.)—Omaha has been selected as headquarters for Halley Aviation Management, Inc. according to Walter F Halley, president. The Halley organization which has maintained headquarters at Rapid City, S D controls the activities of Pioneer Lines, Inc., Watertown, S. D. Dakota Airlines, Inc. Sioux Falls, S D. Rapid Air Lines Inc. Rapid City, S D, and Rapid Aviation Inc. Omaha

With part of the office equipment already shipped here A. W. Spence general manager, is arranging for office and show room space sufficient to display at least one airplane.

The report reveals that Rapid Aviation has received the agency for Bellanca planes. Halley Aviation Management concerns itself with almost every department of aviation except plane manufacturing. It will chiefly devote its interests, Mr Spence said to the promotion of plane sales and the supervision of air routes. The four companies of the Halley group operate airports with schools, taxi work etc

"Sky Fleet" at Nashville

NASHVILLE (TENN.)—Members of the Lions Club here greeted the Aristocrat plane air fleet of the General Tire and Rubber Company when it landed at McConnell Field on its country-wide tour. William O'Neill, president of the company, was also at the airport when the fliers landed

Flown eastward from Moscow to the United States via the Aleutians—the tri-engined "Land of the Soviets." Note the various points in which the design of the Russian plane differs from our own practice. The housing of the nose engine is especially interesting

Eagle Good Will Flight Pauses

KANSAS CITY (MO.)—The American Eagle Corporation's good will tour, a flight of six planes visiting airports and American Eagle dealers in all sections of the country, has completed its swing through Michigan and Illinois and has returned to this city for a week's rest prior to continuation of the tour to the West Coast via the Southwest.

Code Rules Against Loan of Oil Equipment

NEW YORK (N. Y.)—Of interest to the aircraft industry is Rule 8, Group II of the "National Code of Practices for Marketing Refined Petroleum Products," authorized by the Federal Trade Commission and recently issued with interpretations by the National Committee on Interpretation American Petroleum Institute. The Rule reads: "On account of the special nature of service required in supplying petroleum products to airports, no dispensing or storage equipment of any kind shall be leased, loaned or otherwise furnished, to airport operators or resellers of petroleum products except at full cost, including cost of equipment and storage installation."

It is pointed out that this rule does not mean that a company is forbidden to set up service stations at airports through its own organization. Oil firms may enter a district, lease ground and erect stations, it is stated, but through this ruling they may not loan equipment to any firm already established

Wildcat Activity Opposed

MILWAUKEE (WIS.)—A campaign for aerial safety has been launched here by the district attorney's office and aeronautical groups. Some fifteen unlicensed planes were being operated in Milwaukee county when the district attorney's office, the Association of Commerce and the Milwaukee chapter, National Aeronautics Association, took steps to curb "wildcat" activity. Sheriff Reichenbach assigned deputies to canvass the entire county and to arrest operators of unlicensed planes and to give unlicensed pilots final warning that prosecution will follow any recurrence of "wildcat" activity

Air Tour to Precede Western Aircraft Show

LOS ANGELES (CALIF.)—An all-California air tour lasting four days and stopping at 13 cities will be held just prior to the Western Aircraft Show, and an Air Week will be designated during the period of the Show under the direction of the Los Angeles Junior Chamber of Commerce. The purpose of Air Week will be to get as many people into the air as possible and as many as possible to attend the Air Show. A plan has been worked out whereby anyone attending the Aircraft Show can ride at half price at any recognized airport in this territory. Definite entries of 40 aircraft have been made for the Nov. 9-16 exhibit and it is thought that double this number of planes will be in place in the show building when the doors are thrown open to the public.

Howard Miller, of the Los Angeles Chamber of Commerce, has been named secretary of the California Aircraft Exposition Association to succeed Frank Bireley, resigned. Miller will actively assist in directing the Western show

Waco Reports Sales, Earnings

TROY (OHIO)—Waco Aircraft Company, this city, received orders for twenty airplanes during the first seven days of October, as against 21 planes for the entire month of October, 1928. Estimated net earnings of the company for the third quarter, after Federal taxes were $83,000. For the six months ending June 30 earnings after taxes were $138,000, and for the nine months $221,000. This compares with earnings of $229,000 for the entire year of 1928. Dividend requirements for the current year are $145,000

Dominion Orders 13 Vickers

MONTREAL (P. Q.)—An order for thirteen flying boats has just been received by Canadian Vickers, Ltd., from the Canadian Government. Three will be delivered this fall and the remainder in the spring and are to be used for forest patrol work, photography etc. This is termed the largest single order for planes ever placed with a Canadian firm

Montreal Show Held At St. Hubert Airport

MONTREAL (QUE.)—Montreal's air pageant of Oct. 5 6 has been termed one of the most spectacular shows held in the Dominion, with thousands attracted to the St. Hubert airport

The usual competition for prizes and display flying featured the first day of the meet. The public was especially attracted by the exhibition flying of the First Pursuit Squadron of the U. S. Army Air Corps.

Participating airmen were tendered a banquet at the close of the first day, and prizes were awarded to winners of the events held in the afternoon. The awards were as follows: Open landing, Capt F G M Sparks first, Capt E. L. Capreol and Capt. Harry Spooner tied for second. Ab initio landing, F. A. Peacock, first, W. A Henry second. Ab initio race, J. M. McConnell, Montreal Light Aero Club, first, Carl Stone, Granby Aero Club, second, and F. Christmas, Flying and Service pupil, third. Inter-Club relay race, Montreal Light Aero Club team, J. G. Webster, Marshall Foss, and J. M. McConnell. Montreal Derby, G. I. Steeves, first, and Capt. F. G. M. Sparks, second

The arrival of the National Air Tour planes featured the second day with approximately forty thousand persons present—a record attendance

Parks Planes Use J-6 and Bear

ST LOUIS (MO.)—Parks Air College, Inc., is planning several new engine installations for its planes, it is announced here. A Parks P-1 powered with a Dayton Bear four-in-line engine rated at 110 hp. is one of the experimental craft now undergoing flight tests. A P-2 powered with a Wright 5-cyl. J-6 also is being tested. A wide selection of colors is available to purchasers of Parks machines. Among the combinations are orange wings with the fuselage in dark green, maroon, light green, brown, red, dark blue and tan. Other combinations include tan fuselage and cream wings and blue, green and maroon with silver wings. The color option is available not only to purchasers of the P-2, a sport biplane now shown with an Axelson 7-cyl. radial engine developing 115 hp., but also in the P-1, an all-purpose biplane now powered with an OX-5 engine

Army Orders 380 P. & W.'s

NEW YORK (N. Y.)—Contracts for 380 engines and a large number of spare parts for the Army has been consummated by Pratt & Whitney Aircraft Company within the past few weeks. Approximately $2,355,000 is involved in this order, delivery of which will start in October. Another order recently received was one from the Navy for spare Wasp and Hornet parts valued at $500,000. The company plans a 200 per month engine production schedule for the rest of this year

Graf Brought Harmful Insects

WASHINGTON (D. C.)—Flowers seized from passengers and officers of the Graf Zeppelin when it landed at Lakehurst, N. J. on its world tour were found to hold seven species of insects injurious to fruits and flowers. This fact was disclosed by the Plant Quarantine Administration, Department of Agriculture, which stated that only one was known to occur in this country while several have caused considerable damage abroad

Midwest Firm Pays Dividends

OMAHA (NEB.)—President Lawrence Enzminger of the Midwest Aviation Corporation stated in a report recently that the company is paying initial quarterly dividends on its convertible preferred stock

Additional Stinson Equipment to China

WAYNE (MICH.)—An order for additional airplane equipment has been received from the Chinese Nationalist Government by the Stinson Aircraft Corporation, according to Edward A. Stinson, president.

The order calls for immediate delivery of two six-place Stinson-Detroiters and two four-place Stinson Junior cabin monoplanes. Both models are to be powered with Wright "Whirlwind" engines, the large model using the 300 hp. J-6 and the Junior models 225 hp. plants. The latest order was received after a preceding shipment of four Stinson-Detroiters had proved satisfactory on the first Chinese air-mail route between Shanghai and Nanking. Service was instituted on this route June 8 with daily round trip between the two cities, a distance of 165 mi. Increase in mail and passengers has necessitated the routing of two planes each way daily. The new Stinson planes are to be used immediately. As soon as the route can be surveyed the service will extend to Hankow with an added extension to Chengtu, the capital of Szechwan.

Flight Timer Devised

BOSTON (MASS.)—Theodore Kenyon, of Boston Airport, has developed and patented an automatic timing device to measure airplane flight time. It consists of a watch with a diaphragm operated by air pressure through a tube from the air speed indicator. Unless the plane is flying the clock mechanism is braked. When the airplane is flying the air pressure releases the brake

viation Offenses Doubled Last Year

But Increase in Flying Overbalanced Violations

WASHINGTON (D. C.)—There have been more than double the number of air regulation violations during the past fiscal year, according to an oral report of the Aeronautics Branch, but this has not been in proportion to the increased number of planes in operation and greater number of hours flown

The majority of violations have been by fliers doing itinerant and miscellaneous flying rather than by pilots on regular operating schedules with transport and aviation companies, it was said. The larger companies who operate on regular schedules impose strict obedience to the air regulations and cooperate with the Department of Commerce, Aeronautics Branch

Infractions Number 493

The greatest number of violations of air regulations, it was stated, have consisted of acrobatics over prohibited areas, flying low over congested areas, flying licensed aircraft without a pilot's license, flying with no identification numbers displayed, and flying without navigation lights

The number of planes in operation has doubled over the previous year and the number of flying hours has been increased ten times

There were 224 violations in the fiscal year ending July 1, 1928, while there were 493 in the past fiscal year. In 1928 the civil penalty was imposed upon 65, 121 were reprimanded, 22 licenses were revoked, five were denied licenses because of violations, 22 cases of violations were closed for lack of evidence and a public hearing was asked for seven.

Inspectors Report Cases

In the fiscal year ending July, 1929, 176 were assessed the civil penalty, 76 pilots were suspended, 21 licenses were revoked, licenses were denied six, reprimands were issued to 192, 12 cases were referred to the Department of Justice, public hearings were asked for six violators. Fines were collected to the amount of $4,525, it was stated.

In giving an explanation of the methods used in the enforcement of air regulations, it was pointed out that complaints sometimes received from individuals are referred to inspectors for investigation. The greater number of cases, however, are reported to the Department by the inspector who finds violations during his work in the field

As a general rule the violator is given 15 days in which to make a request in affidavit for remission or mitigation of penalty imposed. If a reasonable explanation of the violation is made, recommendation is made to the Secretary of Commerce that the penalty be mitigated or remitted as provided in the Air Commerce Act

Auto Group Addressed On Exporting of Aircraft

NEW YORK (N. Y.)—Aircraft exports and air transportation were discussed here at a meeting of the Overseas Automotive Club Oct. 10. John S. Allard, vice-president and general manager of Curtiss Aeroplane Export Company; F. H. Love, president of United Aircraft Export Corporation, and Maj. C. H. Biddlecombe, advertising manager of Wright Aeronautical Corporation were the speakers.

Mr. Allard's views were that the aircraft export industry might well be patterned after the system set up by automotive interests thoughout the world. In fact, it was his opinion auto dealers were the most likely and best fitted group to take up the sale of aircraft, as automotive bases required only a few things such as landing fields and equipment, a ground crew, etc., to become adapted for aviation purposes.

A caution to the aeronautical industry to guard itself against some of the early mistakes made in the automobile world such as overproduction and the lack of spare parts when shipping planes abroad, was voiced by Mr. Love. No large number of planes will be sold in the individual owner field for the present, he believed, but the transport lines are rapidly shaping such a market by their development and safety in operations.

Airlines Important Markets

Argentina was mentioned as a large possible export field for small planes due to the presence of so many large ranches far distant from any railroad or town. At present, it is the transport and mail lines rather than the general public which offer sale opportunities.

A brief review of air transportation in this country was outlined by Major Biddlecombe, who spoke of the recent conferences in Washington held between air mail contractors and the Government. On the present basis airlines make about $1.09 per mile and the pilot earns approximately $1.97 for every pound of mail carried. The Government is suffering about a three million dollar deficit a year as conditions now exist, and believes a lower rate of pay should be agreed upon.

This means, Biddlecombe continued, that the transport companies must make up the difference by increasing their passenger and freight business. There is not a single long distance passenger route being operated today which isn't losing money, observed the speaker.

Public Must Use Lines

"The American people are faced with one of two things. Either they must support airlines by using them or air transport will suffer a serious setback which is liable to handicap the industry for a number of years," declared Major Biddlecombe. "Approximately a billion dollars is invested in air transport and equipment today and the public was interested to the extent of $94,500,000 the first three months of this year."

Rusco Branch at Los Angeles

LOS ANGELES (CALIF.)—Announcement is made of the establishment of another Rusco factory branch by F. A. Gerrard, Pacific Coast manager for Russell Manufacturing Company, with headquarters in San Francisco. The new base is at 1223 South Olive Street, this city. Kenneth L. Shaw has been named manager. Complete stocks of Rusco Aero Rings and brake lining will be carried.

August Leading Month For Irving Chute Firm

BUFFALO (N. Y.)—Reports from the factory here of Irving Air Chute Company, Inc., indicate net earnings of $70,559 for the month of August after taxes were subtracted, which makes it the largest month in the history of the firm. Exclusive of the British subsidiary, $116,000 in net earnings were the results for the two months, July and August.

Estimating September earnings and adding earnings of the British subsidiary, the third quarter should conservatively show a net of $160,000 or more than the dividend requirements for the entire last half of the year and at the annual rate of over $600,000. Net for the first six months was $251,689, so that the first nine months of this year will show better than $410,000 as against $417,000 for all of 1928, according to the statement.

Unfilled orders for the American factory alone on October 4 amounted to 1,549 parachutes which with the current business insures capacity operations for six months to come. The English subsidiary is proportionately well supplied with orders, it is reported.

Tour Brings "Sunbeam" Sales

VAN NUYS (CALIF.)—Commercial Aircraft Corporation, Ltd., reports seven orders taken by Arthur B. Green general manager, during a tour of the Western states which has just been completed. Three planes are to be delivered in Omaha, Neb.; one goes to Gold Ace Mining Company, Las Vegas, Nev.; two will go to Salt Lake City, Utah; and one to Amarillo, Tex. The Commercial factory is now in production on the "Sunbeam" six-place, single engine cabin biplane at the rate of one plane each three weeks.

Chutes for Glider Targets

WASHINGTON (D. C.)—Gliders used as targets by anti-aircraft guns will soon be equipped with small parachutes, according to War Department officials. These gliders which have a ten-foot span, can be used over again if they are kept from crashing. Therefore after they have been released by the plane towing them, gliders will have a chute to operate on a time fuse, allowing them to settle slowly to the ground without damage.

Parks College Sells Airplane With Course

ST. LOUIS (MO.)—Under a new plan devised by Parks Air College here, a transport license course and a new plane are offered for $5,650, which means a saving of $1,285 over the regular price of the course and a plane, which would total $6,935.

It is the idea of the college to give the student his plane (either a Travel Air or a Parks P-1 biplane), after 30 hr. of flying and have him use it for the remainder of the course. As well as furnishing oil, fuel, and service for the student's craft free, ten hours of solo night flying instruction and the ground school is included in this combination course. These two types of instruction will be given on Parks' training fleet planes.

Harry P. Mammen, president of the college, who announced the new plans, said many of the students trying for transport licenses will avail themselves of this offer. Students will be allowed, he said, to use their craft over the week-ends and for outside activities but it is understood they will not carry passengers until limited commercial ratings are secured.

Brock and Schlee Honored

DETROIT (MICH.)—Award of the Harmon Medaille d'Honneur to Edward F. Schlee and William S. Brock in recognition of their flight in 1927 from the United States eastward to Tokio was made recently by the International League of Aviators. The Harmon Trophy goes yearly to the pilot considered to have made the outstanding contribution to aviation throughout the world while the Medaille goes to pilots whose contributions have been thought worthy of international acclaim. In the long flight to Japan, the Stinson-Detroiter used was flown nearly 12,295 mi. in eighteen days involving 145 hr. of flying. The flight is regarded highly because of the great distance covered in a short elapsed time as well as for the accuracy in holding to schedule.

Martin Firm in New Plant

BALTIMORE (MD.)—The Glenn L. Martin Company has moved into its new factory near Middle River. With equipment, it represents an outlay of $2,000,000 and is considered as one of the finest aircraft factories in the United States. This represents but one unit of the completed factory as proposed. The Glenn L. Martin Company at present has contracts to build service planes amounting to approximately $3,000,000. Although the company has in the past manufactured only service planes, work is now in progress, it is understood, on a large seaplane designed for commercial use. About 200 acres of the 1,000 acre airport adjoining the factory has been graded and work is progressing on the remaining portion.

Schools and Colleges

NEW ORLEANS AIR ACADEMY, using the Rankin system of flight instruction, will be opened as the first unit of a chain of schools to be operated by New Orleans Air Transport, Inc.

SOUTHERN AIR EXPRESS, INC., will establish a plant and training school at the municipal airport, Montgomery, Ala.

UNIVERSITY OF DAYTON, Dayton, Ohio, is offering a course in elements of aerodynamics and airplane design.

THOMPSON AERONAUTICAL CORPORATION is constructing an $80,000 hangar at Pontiac, Mich., which will contain classrooms for a new flying school.

PRINCETON UNIVERSITY has instituted a course in theoretical and applied aeronautics under the Professorship of Alexander Klemin.

BERLINER-JOYCE AIRCRAFT CORPORATION will sponsor a new school in Baltimore, Md., offering courses in aircraft manufacture.

ALLIANCE AIRCRAFT CORPORATION has organized a school at Alliance, Ohio, to furnish instruction for master mechanics and navigators. J. P. McDermott is manager.

CENTRAL Y. M. C. A., Waterbury, Conn., has instituted a ground course in aviation, in cooperation with L. & H. Aircraft Corporation and Colonial Flying Service.

CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa., is to have a wind tunnel of the Gottingen type, as well as a rib-testing machine and special equipment for the calibration of aeronautical instruments.

WASHINGTON UNIVERSITY ground school, St. Louis, Mo., has been recognized by the Navy Department and its graduates hereafter will be eligible for flight training with pay at the Naval air station, Pensacola, Fla.

SKY HARBOR FLYING SCHOOL, operated by Chicago Air Service, Inc., has opened in its new six-story building at 1801 South Michigan Boulevard.

UNIVERSITY OF ALABAMA is offering a full four-year course in aeronautical engineering, leading to the B.Sc. degree.

HILL AERONAUTICAL SCHOOL, Portland, Ore., has been consolidated with Portland Airways, Inc.

CONSOLIDATED AIR COLLEGE is the name of a new school which combines those formerly operated by National Air Industries and Commercial Airways, Inc., Kansas City, Mo.

UNIVERSAL AVIATION SCHOOLS welding instructors met recently for conference at St. Paul, Minn.

COLONIAL FLYING SERVICE has opened a school at Albany, N. Y., in co-operation with Union College, Schenectady.

SPARTAN SCHOOL OF AERONAUTICS, Tulsa, Okla., will use slow-motion pictures as part of its training.

Colby on Berry Brothers Tour

DETROIT (MICH.)—T. B. Colby, manager of the aviation division of Berry Brothers, Inc., is making a business air tour of the Western States. He took off Oct. 2 from here and is visiting numerous aircraft manufacturers and distributors in Kansas, Nebraska, Oklahoma, Texas and California before returning. Mr. Colby estimates his present trip would have taken six months by land travel. He figures the operating cost of his airplane as comparatively quite low. The difference in expense between air and rail travel is more than offset by economy in time and other savings, stated Mr. Colby in telling of his flight.

Madisonians Win at Janesville

JANESVILLE (WIS.)—A quartet of Madison fliers won five prizes at the Wisconsin Air Races held at Janesville Saturday and Sunday, Oct. 5 and 6. First place in the free-for-all Saturday was captured by Richard Conover, flying an Eaglerock plane with a Comet engine. Frank Dean took second place in the exhibition flying. Howard Morey, flying a Monoprep, won first in exhibition flying and second place in the reliability race for all planes run Sunday. Dan Fowley took first place in the exhibition flying contests Saturday. The Madison fliers won their prizes from a field of fourteen entries.

Many Planes at Oil Exposition

TULSA (OKLA.)—More than one hundred and fifty planes participated in the aerial races and exhibition held in connection with the International Petroleum Exposition here. Free-for-all races and the "On-To-Tulsa Derby" were feature attractions. William Parker placed first in the Derby held Saturday Oct. 5, with James G. Haizlip second and Erret Williams third. Display flying demonstrations by Freddy Lund were staged Monday as well as several mock battles and formation flying exhibitions during the remainder of the Exposition.

S.A.E. to Hold Five Aeronautic Meetings

LOS ANGELES (CALIF.)—The Society of Automotive Engineers will hold meetings on Tuesday and Wednesday evenings Nov. 12 and 13 at the Alexandria Hotel here, at which time aircraft engines and air transportation will be discussed. This has been scheduled by the Southern California section of the engineers to come during the All Western Aircraft Show which is to be held here Nov. 9-16. Engine design, diesel engines for aircraft, aircraft engine problems, transport planes, air transportation development and transport maintenance will be among the subjects considered.

The Society of Automotive Engineers has also scheduled aeronautic meetings on the following dates in 1930: Jan. 13, Miami, Fla.; Jan. 21, Detroit, Mich. (annual meeting of the S.A.E.); February 15-23, St. Louis, Mo. (during International Aircraft Exposition); April 8 and 9, Detroit, Mich. (during third All-American Aircraft Show, April 5-13).

Representatives Named

CONSOLIDATED—San Diego Air Service Corporation, Paul Mantz, Hancock Foundation, Santa Maria Airlines, Aero Corporation of California, Inc., all in California.

CURTISS FLYING SERVICE—G. A. Stearns, Wichita, Kan.

GREAT LAKES—The Ruckstell Corporation, Ltd., for California, Nevada, Arizona, Utah, Hawaiian Islands.

RUSCO MANUFACTURING COMPANY—Thompson Aeronautical Corporation, Cleveland, Ohio, exclusive distributor franchise for all Rusco products.

RUSSELL PARACHUTE—United Aircraft Exports, Inc., appointed exclusive foreign sales agents.

WACO—Wings Corporation of Philadelphia (Pa.), for eastern Pennsylvania and southern New Jersey.

His One Day Off in a Period of Eight Months, This Hangar Chief Goes Hangar Inspecting

LOS ANGELES (CALIF.)—The sailor who after being at sea for many months spent his one day of shore leave by rowing a boat on the Lake in Central Park in New York, had nothing on Otis Carter, hangar chief at the Metropolitan Airport. Due to the constant activity at the port it has been necessary to keep the hangar chief on constant duty every day in the week for the past eight months. In fact he lives at the port. However, feeling that Carter should have a change of scenery for at least one day, Hal R. Wells, assistant manager, arranged for a substitute hangar chief to relieve him on one day this past week. So with due ceremony Carter took off in his auto to get away from his close association with the many planes.

Upon his return in the evening the first question asked him by his associates was "What kind of a day did you have?" To which Carter replied, "Gee I had a swell time—never enjoyed anything more!"

"What did you do?" and "Where did you go?" were the next queries.

"Why, I spent the day at the Grand Central Airport (Glendale, Calif.), seeing how they run the place and topped it off by having Herb Fahy take me through the Lockheed factory—it was great!"

BRIEFLY

A plea made to President Hoover by Thomas L. Hill, president of the American Society for the Promotion of Aviation, asked that a new cabinet post be made for the handling of all aeronautical problems. Mr Hill also urged passage of the bill pending in Congress, which would appropriate $40 000 000 to provide for free distribution of planes to civilian flying clubs, which would result, he believes, in relieving the training of 250 000 aviators in five years

Intermediate stops on the Chicago-New Orleans line which will be operated by Continental Air Services, Inc, will be made at St Louis, Memphis, Tenn, and Vicksburg Miss

Truscon Steel Company, Columbus, Ohio is considering plans to manufacture the air mail pickup device invented by L S Adams

Headquarters of the eastern division of Curtiss Flying Service to be established at 1209-1217 Charles St, Baltimore, Md

Dr Clayton E Wheeler, who maintains offices in both Los Angeles and San Francisco has made 338 round trips between the two cities on Western Air Express planes during the last year

Walker Airport Ontario, has been removed as a stop on the eastbound air mail service by postal authorities due to a lack of proper lighting facilities

The steel work on the new Curtiss-Caproni factory Baltimore, has been completed and the Board of Estimates of the city has authorized Elmer E Hammond harbor engineer, to increase the amount of grading and other work in preparing the 25-acre tract to the extent of $85 000

A record total of 4 428 lb of air mail was recently brought into the Los Angeles airport by three Western Air Express planes on the New York-Los Angeles route.

Mail plane service will be rendered Dawson City and other parts of Yukon Territory all winter long

Colonial Western Airways, Inc will start operation of night mail service between Albany and Buffalo on Nov 1 according to W Heath Proctor, operations manager By that time, beacons will have been installed every 10 mi on the route

The Federal Radio Commission has granted a license for a one-watt station to Roosevelt Field to be used for broadcasting purposes while making parachute jumps Instructions will be broadcast to students on the ground while the instructor is descending

It is reported officials of Western Air Express and Universal Aviation Corporation are considering an agreement centering around operations at Kansas City it being the Eastern terminus for Western Air Express and a stop on the Universal lines

F Trubee Davison, Assistant Secretary of War, in an address before the New York State Association of Realty Boards at Syracuse Oct. 11 stressed the advisability of placing airports as near the central part of a city or town as possible, as they will eventually become the business centers of the communities.

I B Tribkin is president of the recently formed Louisiana Aeronautical Society New Orleans which is organized with the idea of promoting the establishing of airports

The Chance Vought Corporation has opened headquarters in San Francisco Calif, at 681 Market St

Lieut Harry A Sutton has been awarded the Clarence H Mackay Trophy by Secretary of War Good in recognition of the most meritorious flight service by an army pilot in 1928 for conducting flying tests to determine spinning characteristics of dangerous types of airplanes.

An aerial demonstration is scheduled Oct 19-21 at Gettysburg Pa in connection with ceremonies marking expansion of the local airport.

The Postoffice Department is studying designs for aerial mail cars, which, it is declared, would save some three hours in coast-to-coast mail service. Large transport craft are now being built which can be converted into "mail cars" within 24 hr

The bill concerning Interstate Commerce Commission control of air lines which was introduced into the House of Representatives by Rep Cable (Rep), Ohio has been put before the Senate by Senator Walsh (Dem), Mass.

Restaurant and fueling concessions for the Los Angeles Municipal Airport, formerly known as Mines Field, have been given to Interstate Company and Standard Oil Company of California by approval of the city council

Weather information concerning conditions along the Columbia Gorge airway is now available through the office of Edward L Wells district meteorologist who sends reports received by him to the Swan Island Airport

Planes of the Boeing System have now flown 7 000 000 mi and of this total about three and one-third million were flown at night.

Hanford Tri-State Airlines Inc Sioux City Iowa have purchased the airport equipment of the Kari Keen Aircraft, Inc.

A service hangar has been opened at Lambert-St Louis Airport by Von Hoffmann Aircraft Company which will provide space for private commercial and transient craft

The Bay of Quinte, near Trenton, Can, is to be the site of the new land and seaplane training station of the Royal Canadian Air Force which will move from their present location at Camp Borden The cost of the new station will be approximately $2 000 000

Yakima, Wash is being seriously considered as the terminus for the Alaska-Washington Air Lines following a conference between Yakima aviation enthusiasts and H L Johnson, manager of the Inter-City Air Lines a division of the other corporation Wenatchee Wash is also being considered for the base of operations

Contract for the design and construction of the first unit of a factory for Crosley Airplane Company, Sharon, Ohio has been awarded to The Austin Company, Cleveland and work on it will begin immediately

Rock Island Ill will dedicate a new 3,000 000 cp airplane beacon Oct 21

Omaha Flying Club Inc, has leased Steele Airport and contracted for an American Eagle OX-5 to be used for training

A directional radio beacon with a range of 200-300 mi has been installed at Kelly Field San Antonio, Tex

Brower Air Service Corporation, Lindsborg Kan has started an airline between Omaha Neb and Wichita Kan, with stops at Salina and Bellebilee, Kan

Schenectady (N Y) Glider Club has purchased a Baker McMillan primary training glider and flights have already been made

Midcontinent Air Express is rushing plans for opening its proposed line from Denver to Kansas City

Ryan Aircraft Corporation has completed a model fuselage for a four-place Brougham and expects to have the model in production by December

New Firms Announced

THE AMERICAN PROPELLER COMPANY Baltimore Md, capital 5,000 shares, par value $100 by J Kemp Bartlett, Jr., Robert Dixon Bartlett, J Kemp Bartlett

AERONAUTICAL & INDUSTRIAL HOLDING CORPORATION St Petersburg, Fla., capital 125 000 shares of no par value by Fred V Blair, A P Avery, Oscar Avery to deal in airplanes and airships

WEIANT AIRCRAFT SALES COMPANY, Newark Ohio, capital 100 shares of no par value by Warren S Weiant, Jr., Eleanor Weiant Oscar W Nichols

ACE OF CLUBS FLYING SERVICE, INC., Kansas City, Mo 5 000 shares of no par value by Robert P Gilliam Paul Moss, Harriet Moss D D McCoy, Frank G Warren to operate flying schools and transport passengers and freight

SOUND AIRWAYS, New Bedford, Mass., capital $100 000 by Isaac Dawson, John E Moore David S Sherall, to manufacture and deal in aircraft transport, aerial advertising and photography

AERO-PLANE CORPORATION, Baltimore, Md., capital $3 000 000 by James F Milton Herbert C Craft and Howard Tebbs, to manufacture airplanes.

THE AIRWAYS CORPORATION, Miami, Fla, capital 50 shares no par-value stock by F M Crawford, E L Boyce, and I H Arnold, to deal in aviation securities

PERSONNEL

MISS ELINOR SMITH has been appointed assistant operations manager for Eastern Air Express, Inc New York, N Y

WILLIAM C CANBY has been appointed assistant to vice-president PAUL GOLDSBOROUGH in charge of operations of Universal Aviation Corporation

C E FLEMING, which is with National Air Transport has been made general traffic manager of Southwest Air Fast Express, with headquarters at Tulsa, Okla

L W GREVE was recently elected president of the Cleveland (Ohio) chapter of National Aeronautical Association succeeding FLOYD J LOGAN CLIFFORD GILDERSLEEVE was elected vice-president

N S GLASS has been appointed district passenger representative for Western Air Express at Albuquerque, N M

O S EMBLEM has been appointed district passenger representative for Mid-Continent Air Express Company at Santa Fe, N M

A H RIEDESEL is now manager of Smith Field Iowa City, Ia

HERBERT B WEEKS has been placed in charge of the aerial survey department of Curtiss Flying Service in St. Louis

A J STEWART is now manager for Curtiss Flying Service at the Municipal Airport, Memphis, Tenn.

WILLIAM P HOARE has been made field manager for Boeing Air Transport at Cheyenne Wyo

GEORGE BENDIX is now engineer in the aviation department of Gilbert & Barker Manufacturing Company, makers of the "Aeropit" emergency pump and other items of equipment for aircraft

R E KELLY has been appointed Sales Engineer for the eastern district for The Independent Pneumatic Tool Company Chicago JOHN ASHTON has been made manager of the Boston office

WALTER L SEILER has been appointed chief pilot for Emsco Aircraft Corporation, Downey, Calif

DEANE DAVENPORT has been appointed editor of *Sky-Ways*, official house organ of The Aviation Corporation He was formerly with Braniff division of Universal Airlines

VINTON HIGBIE project engineer for Berliner-Joyce Aircraft Corporation has been appointed instructor of aeronautical drafting at the Maryland Institute

HAROLD H EMMONS chairman of the board of Detroit Aircraft Corporation has been elected chairman of the board of Airport Lighting Inc New York N Y

RALPH DEVORE has been named superintendent in charge of the Pontiac repair base of Thompson Aeronautical Corporation.

RYAL MILLER is the new president of the Sioux City (Ia) chapter of N A A CEDRIC HOSKINS is vice president and CARLTON CORBETT, secretary treasurer

JOHN W SHIVER has been elected president of the Americus Aero Club Americus Ga

CHARLES D STOFFER former Western Air Express pilot, has been appointed chief pilot for Eastern Air Express

JOHN AKERMAN chief designer and engineer for Mohawk Aircraft Corporation Minneapolis has been made associate professor of aeronautical engineering at the University of Minnesota

MISS CECILE MCTIGUE has been appointed assistant treasurer of Robertson Airplane Service Company St Louis

KIRBY L WHITSETT has resigned as Colonial Air Transport pilot to become pilot for New York, Rio and Buenos Aires Line.

WILLIAM F CAREY has been elected president of Curtiss Airports Corporation to succeed WALTER MARVIN, who becomes chairman of the board of directors

LIEUT GEORGE F STRAKER has been appointed field engineer for the eastern district for Szekely Aircraft & Engine Company

ARTHUR P HOMER has been appointed Director of Sales Promotion for Consolidated Instrument Company of America, Inc., New York, N Y Mr Homer was previously connected with the sales department of Waltham Watch Company

CHARLES WALD formerly senior inspector of airplanes for the Bureau of Aeronautics, Navy Department is now inspection engineer for Berliner-Joyce Aircraft Corporation, Baltimore, Md

WALTER STOERIE Casper, Wyo, has been named as a member of the state board of aeronautics.

THOMAS HAVENDON has been appointed sales manager for Curtiss Flying Service at Brideport, Conn

HANS A FELDMANN former general manager of Weeks Aircraft Corporation has been appointed sales manager of Hamilton Metalplane Company Milwaukee Wis

AERONAUTICAL CALENDAR

Oct 5-21	National Air Tour Starting from Ford Airport, Dearborn, Mich
Oct 22	Aeronautic program, A S M E, Akron, during convention to be held Oct 21-23
Oct 24-25	Conference on Municipal Airports at Washington, D C, under auspices of the American Road Builders Association.
Oct 31	Dedication of airport paving at Eighth Annual Asphalt Paving Conference, West Baden, Ind, Oct 28-Nov 1
Nov 7-8	All Western Airport Conference, Los Angeles, Calif
Nov 8-10	Intercollegiate Aeronautic Conference Columbus Ohio
Nov 9-17	Western Aircraft Show, Los Angeles.
Nov 12-15	S A E Aeronautic Meeting Los Angeles Calif
Nov 18	Lehigh Airport Design Competition Closes Lehigh Portland Cement Company
Dec 9-14	Baltimore-Washington Aircraft Show, Baltimore, Md
Dec 10-16	National Aviation Week Mexico including air show and air display at Mexico City
Dec 18	Boy and Airport Conference for New England, Bridgeport, Conn
1930	
Jan 13	S A E Aeronautic Meeting Miami Fla
Jan 21	S A E Annual Meeting, Detroit, Mich
Feb 3-12	New York Aviation Show, auspices Aviation Post, American Legion
Feb 15-23	International Aircraft Exposition, St Louis, Mo
Mar 8-15	Second Annual Pittsburgh Aircraft Show, Motor Square Garden Brown Boulevard Pittsburgh Pa Office is c/o Clark W Thompson, William Penn Hotel
April 5-13	All-America Aircraft Show, Detroit
May 3-10	New York Aircraft Salon, auspices Metropolitan New York Division, Manufacturers-Dealers Section Aeronautical Chamber of Commerce at Madison Square Garden New York City
AIR MEETS	
Oct 18-21	Denver, Colo, Municipal Airport, dedication and races
Oct 19-20	Air Circus at Utica N Y, Municipal Airport.
Oct 26	Mercer Airport, Trenton N J, Dedication and races
Nov 5-7	Air Carnival, Municipal Airport Omaha Neb.
Nov 11	Air Meet, Ranger Tex Airport.
AIRPORT DEDICATIONS	
Oct 20	Curtiss-Reynolds Flying Field Glenview Ill
Nov 11	Duluth Municipal Airport, Duluth, Minn.
Nov 15	Curtiss-Steinberg Airport St. Louis Mo
Nov 15	Kinsolving Airport Abilene Tex.

TRADE TIPS

It has been reported that

The Midwest Aviation Corporation of Omaha, Neb, is planning erection of a hangar in Des Moines Ia, where it has been operating a flying school for the past eight months but has been using a hangar of the Yellow Cab Airways

The Fairfax Airport Co 407 Security Bldg Kansas City, is considering bids for reconstruction of its administration building on corner of Fairfax Airport and Funston Road

The Royal Airways Corporation of Madison, Wis, is having plans prepared for an administration building at Pennco Field.

The Dallas Airport Utilities Corp, of Dallas Tex is about to let the contract for erection of hangar, machine shops and administration building at Love Field to be leased to Southern Air Transport, Inc of Fort Worth Tex.

The Neilson Steel Aircraft Co, Second and Camelia Streets Berkeley, Cal., is having plans prepared for 60x200 ft plant addition

The city clerk of Fresno Cal, has been authorized to take bids on construction of a residence and administration building at the municipal airport of that city

Fairfax Airports, Inc, of Kansas City Kan., is to erect a club house at the municipal airport of St Joseph Mo, which it recently acquired and also a hangar

AIRPORTS AND AIRLINES

New Orleans to Have Class A Naval Airport

WASHINGTON (D C)—Construction of a Class A naval airport at Algiers, across the Mississippi River from New Orleans, La, has been decided upon by the Navy Department. A total area of 83 acres is available, although only an L-shaped tract of 33 acres will be developed immediately. The work of preparing the site including removal of the Veterans' bureau hospital, will be begun almost immediately, and according to the announcement, the project will be well under way by the end of the current fiscal year.

Detailed plans for the airport were prepared by Commander Ernest Lee Jahncke, assistant Secretary of the Navy. The L-shaped field will provide a north and south runway about 2,500x875 ft, and an east and west runway about 3,400x400 ft. Accommodations for seaplanes will be provided along a 600 ft. frontage on the river. At first, these will consist of a timber runway for hauling and launching equipment, and a small building to house supplies. Construction of a mooring mast for dirigibles is also being considered.

Although it is not the Navy's policy to encourage commercial use of its air ports, the field will be available at all times as an emergency landing field for all land and seaplanes. It will also afford an excellent base for relief flights by naval aircraft in the event of floods on the lower Mississippi. The Algiers naval station is within twenty minutes automobile drive from the New Orleans Post Office.

New Air Mail Route Planned

WASHINGTON (D C)—The Post-office Department will soon offer advertisements for an air mail route between Norfolk, Va, Washington, D C, Pittsburgh Pa, and Cleveland Ohio according to Assistant Postmaster General Glover. The Cleveland-Pittsburgh section has already been lighted for night flying and the Pittsburgh-Washington route has been surveyed by the Department of Commerce and is expected to be lighted by April, 1930.

Toledo Gets Excursion Rates

TOLEDO (OHIO)—Universal Aviation Company, operating between Cleveland and Chicago, Middle States Air Lines, Inc, the Mason and Dixon Air Lines Inc, and Thompson Aeronautical Corporation, all serving Toledo, have notified the Chamber of Commerce that they will put into effect air excursion rates during the Toledo Industrial Progress Exposition Nov 7

W.A.E. Buys Three New Fords

ST. LOUIS (MO)—Three new tri-engined Ford transports have been added to the fleet of Southwest Air Fast Express. The new all-metal monoplanes are of the latest design.

Announce Air-Rail Line From Boston to Havana

NEW YORK (N. Y.)—A 43-hr plane-and-train service from Boston to Havana will be inaugurated on Nov 1, according to an announcement made by J. M. Eaton, traffic manager of Pan-American Airways. A through train will be run from Boston called the "Everglades Special" leaving South Street station at 4 30 p m daily, and arriving at Miami the second morning at 7 50. At 8 45 the plane will leave for Havana, reaching there at 11 a m. Plane connections will be made from there to South America.

Co-operating with Pan-American Airways in this plan are the New York New Haven & Hartford, Pennsylvania, Richmond, Fredericksburg & Potomac, Atlantic Coast Line, and the Florida East Line railroads.

A plane leaving Havana to connect at Miami with the northbound "Everglades Special," will be known as the "Boston Special." Daily service will be started by Pan-American between Nassau and Miami on Jan 1 which will also connect with the Boston train.

New Airport Bulletins Ready

WASHINGTON (D C)—Department of Commerce announces that two new aeronautical publications are now ready for distribution. The first of these has to do with airport problems and is titled "Notes on Airport Management." "Suggested City and County Aeronautics Ordinance and Uniform Rules for Airports" is the name of the second bulletin which outlines certain rules and regulations for use in state laws on aviation. Both pamphlets may be had by writing to the Aeronautics Branch, Department of Commerce.

Dedicate St. Louis Beacons

ST LOUIS (MO)—Three beacons, each of 8,000,000 c.p. have been installed on the 157-ft Grand boulevard water tower here and were formally dedicated Oct 14. Two throw beams visible for 25 to 50 mi toward both Lambert-St Louis Field and Parks Airport and the third is an elevated revolving light. The total cost was $3,000. The beacons were installed by the North St Louis Business Men's Association. Prominent local aviation men officiated in the dedication.

Curtiss-Wright Buys Site Near San Francisco

SAN MATEO (CALIF)—Purchase of a 400-acre tract of land, located about four miles south of this city at a cost of about $500,000 has been announced by Curtiss-Wright interests. An airport will be developed on this property by the Curtiss company at an approximate expenditure of $1,500,000. A part of the field will be reserved for the Curtiss-Wright Flying Service school, which will be one of the first activities to be established and the remaining portion of the field will be available for commercial aviation operations, according to Captain Bartlett, general manager of Curtiss Flying Service in California. No flying school other than their own will be permitted to operate at this airport.

The Pacific Gas and Electric Company, Calif, has agreed to move its transmission line which at the present time is located on this property. This agreement, as well as other concessions necessary before the property could be developed as an airport, were secured through the cooperation of the San Francisco and San Mateo Chambers of Commerce, and civic-minded property owners in the vicinity.

Maddux Set Record in August

LOS ANGELES (CALIF)—Maddux Air Lines carried a total of approximately 6,800 pay passengers during the month of August, a new all-time record for Maddux operations. Of this number 4,400 passengers were carried by regularly scheduled transport planes flying over the San Diego-Los Angeles-San Francisco route, about 2,200 were carried on short scenic flights and approximately 200 on charter trips. Maddux tri-engined Ford planes flew 1,100 hr during August, covered a total of about 107,000 mi and piled up a grand total for the month of 727,600 passenger miles flown without mishap or default.

Start Boston-Coast Air-Rail Line

BOSTON (MASS)—A new combination train-airplane service to California from this city was inaugurated October 7 by Western Air Express and Boston & Albany Railroad. The service cuts the time to the west coast to 53 hr from Boston and to 46 hr from New York. It reduces the present lowest time of 48 hr from New York and 67 hr from Boston. It was announced that Western Air Express expects to operate air lines from other Pacific to Atlantic points as soon as routes are selected and arrangements completed. Tri-engined Fokkers will be used.

Plan Additional Port For New York City Area

NEW YORK (N Y)—New York Airport, Inc., organized by Lawrence Halleran, has acquired 305 acres of land between Flushing and College Point, L I, in the Borough of Queens, and has begun development of the site for an airport. In addition, the company has acquired four acres of land on Flushing Bay to be used for a seaplane landing. Besides the airport, an "aeronautical park" is planned, to include tennis courts, restaurant and an artifical lake. The project is expected to cost $700,000, and including the property, involves about $2,500,000.

This site was recommended by the Hoover Fact-finding committee on suitable airport facilities for the New York Metropolitan district in its 1927 report. The Queens-Flushing Bay area also has two other sites under development, one for seaplanes and one for landplanes, and still another is projected. The one to be developed by New York City Airport, Inc, is only one-half mile from direct subway connection to the downtown district and two blocks from Northern Boulevard Flushing.

Plan Northern Michigan Line

GRAND RAPIDS (MICH)—December will see the inauguration of year-round airline service between this city and Petoskey, in the northern part of the state, according to announcement of plans by Jack Byrne, president of Furniture Capital Air Service. Intervening stops will be made at Big Rapids, Cadillac, Traverse City and Charlevoix. Two Wasp-powered eight-place Stinson cabin planes are planned to provide daily service each way.

Air Mail Less in September

WASHINGTON (D C)—During September, the total amount of air mail carried was 655,689 lb, a decrease of 42,373 lb from the August figure. Detailed figures of poundage over the various routes for the past three months follow:

		July	August	September
Boston-N Y	192	13,954	13 122	9,021
Chicago-St. L.	278	7,611	8,219	7,518
Chicago-Dallas	1 039	36,882	41 600	37 977
Salt L Los Ang	600	65,059	69 505	64,221
Salt Lake-Pasco	530	18 146	20 344	24,126
Seattle-Los Ang.	1 141	23,870	25 224	22 793
Chicago-Minn	503	20 134	26,931	19 180
Cleve Pitts	123	5,687	6 771	6,709
Chey Pueblo	199	9 475	10 401	8 903
Cleve L'ville	345	13,622	11,083	10 189
N Y-Chicago	718	156,178	163 534	153 077
Chicago-San F	1,932	157,502	169 285	158,987
N Y Atlanta	763	32,017	33 832	31 062
Albany-Cleve	446	8,641	9,814	7,930
Dallas-Galv	320	3 541	3 673	3 561
Dallas-Browns	529	6 823	7 490	7 025
Atlanta-New O	485	7 750	8 507	7 622
Chicago-Cin	270	6 920	8 510	9 157
Atlanta Miami	736	8,624	9 798	9 551
G Falls-Salt L	489	7 297	7 529	6,752
Chi-Bay City	712	10 866	23 950	16,883
St. L.-Omaha	403	5 219	5 623	5 814
New O Houston	319	3,748	4 200	3,596
Chi Atlanta	768	8 226	9 117	2,912
Pasco-Port-Seattle-Spokane	449	0	0	11 282
	15,022	638 918	698,062	655 689

Daily average 21,856 pounds for September

Mail Plane Replaces Dog Sleds

PORTLAND (ORE)—Mail formerly carried by dog sleds from Nome to Unalakleet, Alaska, will hereafter be carried by plane. The time will thus be reduced from six days to about 2 hr for the 200 mi. Pete Curran, who operated the sled route, is one of the partners in Alaska Air Service, Inc, which will take over the mail contract. A four-place Stinson Junior monoplane will be used.

Boston Will Broadcast Radio Direction Signals

BOSTON (MASS.)—Radio beam service and 24-hr broadcast of aviation weather reports will be provided by the stations which have been installed by the Department of Commerce on Castle Island in Boston Harbor, and at Boston Airport. A weather bureau will be maintained at Castle Island, and reports from other points in the district will be received there and sent by radio telephone to the airport station. In addition the airport will have a telegraph printer system which will furnish weather information for airways all over the United States.

The broadcast of directional signals will be continuous, interrupted only by the sending of the weather reports on the same wave length every 15 min. The equipment installed at one corner of the airport consists of two 40-ft poles and a small building to house the apparatus. All of the Boston-New York planes operated by Colonial Air Transport have been supplied with radio sets to receive the signals and weather information.

Curtiss Group Inspects Projects

NEW YORK (N Y)—Leaving here Oct 7, a party of officials of the Curtiss Airports Corporation began a three weeks' tour of the various projects in which the company is interested throughout the country. Among the places to be visited are Pittsburgh, St. Louis, Houston, Los Angeles, Alameda, San Francisco, San Mateo, Chicago, Milwaukee and Cleveland. The group will include Walter S. Marvin, chairman of the board; William F. Carey, president; David Visel, vice-president; B. R. Waite, chief engineer; Jack F. Tuyls, field engineer; H. W. Kroyer, treasurer, and Col. G. W. Goethals, of New York Air Terminals.

Three French Firms to Merge

PARIS (FRANCE)—Three firms will be included in a merger which is being planned under the presidency of M. Nicaise. The new firm will be known as Societe Generale Aeronautique, and will include Societe Lorraine, manufacturers of airplane engines, Societe Anonyme Nieuport-Delage, producers of light passenger transports, and Avions R. Hanriot, builders of training planes. The capitalization of the combined firms will be about $80,000,000.

Negotiations for Mail Rate Reduction Continue

WASHINGTON (D. C)—Since the various transport companies whose air mail contracts expire this year have failed to agree on a formula for rate reduction, the Post Office department is discussing contract rates with the companies individually. However, conferences are continuing, and it is hoped that a suitable "yardstick" to be applied generally to air mail rates may yet be found. In the meantime, Western Air Express and Colonial Airways are objecting to very drastic reductions of their compensation, proposed cuts from $3.00 per pound to $.93 and $1.42, respectively. The other contractors have indicated their willingness to accept the lesser cuts proposed to them by the Post Office Department.

Postmaster General Brown and Clarence M. Young have both reiterated their statements that the air transport industry is not yet ready for regulation and fixing of rates on the same basis as that applied to railroads, but the Postmaster General has also indicated his belief that the Government should reduce the amount now spent yearly to aid the aviation industry, both as to losses on air mail, and the expense of establishing new landing fields and lighted airways. In a recent address before the Advertising Club of Washington, he stated that the Government was spending $30,000,000 a year to aid commercial flying, and he expressed the hope that a saving of $3,000,000 per year might be effected by cutting out the air mail deficit.

To Test Seadrome Model

BALTIMORE (MD)—A model of the Armstrong seadrome, one thirty-second of the size of the original, will be tested on the Choptank River or Chesapeake Bay, Oct 15, or as soon after as the tides and weather permit. The miniature model which took thirteen weeks and $10,000 to construct, weighs 2,000 lb, stands 10½ ft. high, is 10½ ft across and is 35 ft. long. The large model, when completed, will be 1,180 ft long. The model was constructed at Chester, Md., and was brought by truck to Cambridge, Md., where it will be loaded on a miniature drydock and floated to the site of the tests. Edward R. Armstrong, the inventor, will supervise the tests, according to the announcements which have been made here.

Canadian Air Mail Grows

OTTAWA (ONT)—Tremendous growth in Canada's air mail service in the past year and a half is indicated by the latest official figures issued recently. In December, 1927, the total air mail mileage was 367 mi, while today it is over 3,000 mi. The number of scheduled flights per month has grown from three to over 300 and the monthly mileage from 1,000 to nearly 75,000 mi per month.

AIRPORT CONSTRUCTION PROJECTS

WORK HAS BEGUN on the new Fairchild seaplane base, situated on the south shore of the St. Lawrence River about a mile below Longueil Que., and about 4 mi from St. Hubert Airport. A breakwater 1 500 ft long and 30 ft wide built at an angle of 150 degrees to the flow of the river, is to be constructed Fairchild Aircraft, Ltd. owns 265 acres of land fronting on the seaplane base. About 100 acres of this is being developed as a private service and test field. It is being drained and graded, with runways in several directions, the shortest being 1,800 ft long.

Lincoln Flying school's hangar on the Lincoln (Neb.) municipal airport is expected to be completed within six weeks, while Lincoln Airways, Inc., a companion organization will build a hangar on the field next summer. E. J. Sias is president of the two corporations which have the same officers and stockholders. The hangar to be completed soon will have floor space 100 × 80 ft. A city-owned administration building and a gasoline filling station are projects to be started at the municipal field soon.

Most of this season's work on the Omaha (Neb.) municipal airport will be completed by Oct. 1, the greater part of the equipment having been received at Omaha. Fabrication of the beacon tower has been started all floodlights are mounted boundary lights placed and ready for connections, and walls of the switch house are about half completed. The pump for the drainage system has been set up and can be put into operation within a few days if weather permits completion of the drainage system.

More than $60 000 worth of Crouse Hinds night lighting equipment has been installed on the Grand Central Air Terminal, Glendale Calif, under the direction of Horace White illuminating engineer to give the field an airport rating of A1A. Obstruction lights have been placed on all sides of the field boundary lights and runway marker lights installed while four banks of flood lights, with a total of nineteen 3 000 watt units, are used to light the two runways under any wind condition. All buildings are lighted on sides and roofs, a ceiling projector has been installed, and a rotating beacon with green course lights which flash GC (Grand Central) in the International Morse code, is mounted on top of the depot tower.

Installation of night lighting equipment has been completed at the Western Air Express Los Angeles terminal field, under the direction of C. E. Nikirk electrical engineer at a cost of approximately $11,000 Boundary and obstruction lights have been installed around the flying area while the runway is illuminated by a single arc light of 50,000,000 cp.

Northrup Aircraft Corporation Ltd. has begun erection of an office building and 1-room hangar to cost $25 000 at Burbank Cal.

Northwest Airways, Inc. St. Paul, Minn has let the contract for erection of hangar, office building and machine shop at the municipal airport, to cost about $100 000.

Dallas Airports & Utilities Corporation, sponsored by Dallas (Tex.) Chamber of Commerce to improve the city's two municipal airports has let a contract to Airports Engineering & Construction Company, Fort Worth, Tex. for the erection of a hangar to cost $95 000 and an administration building to cost $30 000. The administration building will be 70 x 80 ft, comprising two stories and mezzanine roof. The hangar has a frontage of 200 ft on the landing field and will have a total floor space of about 40 000 sq ft. Both structures have been leased by Southern Air Transport Inc. of which Airports Engineering & Construction Company is a subsidiary. The contractors have been allowed 120 days for completion of both structures.

Frank A Haas city clerk of Davenport Ia. has let the contract for construction of a hangar and lighting system at the municipal airport.

The City Commission of St. Petersburg, Fla., has let the contract for erection of a hangar at the municipal airport, to cost $22 985.

Contract for the municipal airplane hangar to be constructed at St. Petersburg, Fla., has been let to Harry Brothers, New Orleans, La. It will be built of structural steel covered with Robertson Process Metal.

Detroit Aircraft Corporation has authorized an extensive expansion of the facilities at Grosse Ile Airport. Seaplane hangars, service stations and dock facilities will be included in the project which may take a year to complete. The lighting system has already been installed and work of leveling and installing runways will be finished this year. It is anticipated that the perfected airport will represent an investment of $1 300 000.

The Municipal Airport Commission, St. Louis Mo. has directed B. Russell Shaw, Philip R. Love and George W. Foster of Lambert-St Louis Field to draw up a comprehensive plan for the completion of the airport including apportionment of the remaining funds available under the $2 000 000 bond issue.

Denver City Council has appropriated an additional $50 000 to be spent on the Municipal Airport bringing the total cost to $450 000.

Thomas Holmberg, South Tacoma, Wash has been awarded contract for the construction of a permanent hangar 130x200x27 ft. at Tacoma Field. The cost will be $46 950 and construction will be of steel and concrete with wood roof.

Construction of semi-hard runways at Bettis Field Pittsburgh Pa., is progressing rapidly. Tarmac surface has been applied to 32 000 sq yd., and 75 000 sq yd more will soon be completed.

B S Adams, Chicago, president of the Adams Company, Three Forks Mont., is planning an airport there, it is announced

Construction of the first hangar at the new $3 000 000 Curtiss-Steinberg Airport St Louis, Mo, has been started. The building 130x100 ft. will have buff brick exterior finished with glazed tile. One runway 4,900 ft. long and two 3,600 ft long are to be built. According to present schedule, three hangars will be completed by Jan. 1. An administration building school building and overhaul shop are to be started this winter, and other structures are also planned. Stone & Webster Boston, are the general contractors, and the field work has been engineered by Love-Sultan, Inc, St Louis

City Commissioners of Ocean City N. J, have authorized the purchase of a tract of land for an airport for $87 500

Two large concrete and steel hangars to have a capacity of ten planes will be built at Franklin Airport, Franklin Pa.

A new set of boundary lights has been installed at Boston airport

American Airports Corporation New York City, will construct an airport for the city of Newburgh, N. Y., on a 230-acre site.

Curtiss Has Big Season in Maine

BOSTON (MASS) — Joy-hopping operations in Maine of the Curtiss Flying Service, using seaplanes, during the past summer were very successful and profitable. The company carried a total of 3,800 passengers and grossed $50 000, with a net profit of $13 000. Curtiss is working out plans for the establishment of a number of operating bases in Maine at a half dozen strategic points on the Coast and two at inland lakes. A hangar is to be built at the present Rockland base, to be ready next summer

A seaplane and flying boat landing device has been developed there in the shape of a platform mounted on six wheels which run on a 6-degree sloping ramp into the water. The platform is 40 ft. square and may be drawn up by means of a winch and a gas engine in 12 sec. It can be lowered in the same time. It slides into the water sinks just enough to permit the seaplane to taxi onto it and then it is hauled up to the land.

W.A.E. Traffic Increases

LOS ANGELES (CALIF) — Western Air Express planes have travelled over 3,100 000 mi to date according to estimates by company officials. No passenger or passenger-plane pilot has been killed on the line, and no passenger plane has been forced down by engine trouble. The rate of travel this year indicates that about 20 000 persons will have been carried for the twelve months ending Dec 31 1929 which would be an increase of 300 per cent over 1928, according to estimates

FOREIGN ACTIVITIES

Regular Postal Rate Offered for Air Mail

BRUSSELS (BELGIUM)—Air mail between this city and London will be carried at regular postage rates by "Sabena" (Societe Anonyme Belge de Navigation Aerienne). The service will be nightly in both directions. Mail reaching Brussels' Central Post Office before 10 p.m. will be sent to the flying field at Haren in time to be put on the three-engined Sabena plane which leaves at 11. It will be distributed in the first London delivery the following morning and in most of the other towns in England during the day. Similarly mail may be received at Croydon until 12 p.m for the plane to Brussels.

This is said to be the first time in Europe that air mail has been carried at regular postal rates. Adhesive stamps bearing the inscription "By Air-Sabena" are being distributed free

Little Entente Race Winner Used Hornet

PRAGUE (CZECHOSLOVAKIA)—The air tour of the Little Entente and Poland was won by the Czechoslovakian, Joseph Kalla, flying a Prague-built "Letov" plane with Pratt & Whitney Hornet engine, with an average speed of about 160 m.p.h. There were 24 entrants in the competition, which was limited to single-seated pursuit planes, carrying full military equipment. Other planes entered were the French Dewoitine and Spad, and the Italian Fiat

The contest, which took place Sept. 6-7, covered a circuit of about 2,000 mi from Bucharest to Varsovia, Prague, Belgrade, and back to Bucharest. In addition, there were high speed trials over a closed course at Bucharest. An Avia B H-33 with Skoda engine placed first, with a speed of about 135 m.p.h, and a Dewoitine with Hispano engine was second with a speed of about 182 m.p.h.

German Subsidy for S.A. Line

BERLIN (GERMANY) — The German government is providing a subsidy of $730,000 to aid the Deutsche LuftHansa in its attempt to establish an air passenger and mail service to South America. The company has purchased three Rohrbach Romar flying boats to be used on this line.

English Newspaper Offers Air Scholarships

NEWCASTLE (ENGLAND) — Ten scholarships for the training of civilian pilots have been offered by the Newcastle *Evening World*. Those selected for the training may be either men or women between the ages of 17 and 35 and all their fees for instruction up to the point of securing the "A" license will be paid by the newspaper. Training will be given at the local light plane club, one of the chain of English flying clubs

Six students including two women have been selected. The applicant is interviewed by a committee and judged according to intelligence, poise, alertness and apparent fitness. Survivors of this first process of elimination are taken for a flight in which their reactions are observed again. The most promising of these are given physical examinations and, if these are passed are started on the actual flying course. The scheme has been extremely popular

Lufthansa Reports Receipts

BERLIN (GERMANY) — Figures recently released by Deutsche Lufthansa for 1928 operations show a surplus of $2 279 on hand at the end of last year. Of the total receipts $7,938 720 two-thirds were from public subsidies and one third was the actual working receipts. The total is very little larger than that for 1927. A total distance of about 6 250 000 mi was flown in passenger and mail services during 1928

Hornet-powered Czechoslovakian Letov pursuit plane

France Helps Local Airport Developments

PARIS (FRANCE)—Following the policy of M Laurent-Eynac, Air Minister, for the general development of air navigation throughout France, a plan has been devised for government support of local airport projects throughout the country. The first of these is to be undertaken by the Chamber of Commerce of Lyon.

The agreement is for a period of 15 yr but on account of the novelty of this form of development provision is made for the Chamber of Commerce each ten years to withdraw. In case this is done the project reverts to the state. For the first five years of the agreement the state subsidizes the Chamber of Commerce in the event of any losses, within certain limits prescribed by the contract.

The Chamber of Commerce has practically a free hand in the selection of the airport site and its development. The financial and technical control is exercised by agents of the state, however, and such services as radio, theological, and others which tie into the country wide system are provided for by the state.

Revise French Subsidy Terms

PARIS (FRANCE)—Plans for reorganization of French air lines are reported to be under way. A capital of about $2,400 000, is to be supplied, one third of which would go to Compagnie Internationale De Navigation Aerienne, one-third to Societé Generale de Transports Aeriens, (Farman Lines) and the remaining third to the government. Concessions would be issued on a 30-yr basis and airplane manufacturers prohibited from holding more than 25 per cent of any one company. The French government would grant subsidies to the extent of about $1,940 000, and would distribute the subsidy on a basis of the number of passengers and pounds of freight carried which is interpreted as a step toward self-supporting lines.

N.Y.-Rio Line Gets Chile Contract

TAMPA (FLA.)—New York, Rio and Buenos Aires line has been granted a concession to carry 25 per cent of all Chilean mail from Santiago to Buenos Aires Argentina to the West Indies, and to the United States. President Ibanez signed the contract which includes mail carrying rights from Chile to all countries on the east coast of South America. This is the sixth contract signed by the air company with South American republics all of which include passenger-carrying rights.

Mexican Centers Developing Airports

MEXICO CITY (MEXICO)—There is now much activity throughout Mexico in the matter of airports. Two towns in the central state of San Luis Potosi—Cardenas and Rio Verde—have just inaugurated airports and work is being completed on landing fields at the towns of Guerrero and Valles in the same state. These towns are on air routes which connect Mexico City with the United States border

In order to hasten the completion of the airport at Ciudad Juarez, the Chamber of Commerce and the Rotary Club of that town are co-operating with the municipal and state government officials, according to dispatches received here. It is planned to make this port one of finest in Mexico and it is expected that it will be ready well before the National Aviation Week

The town of Yurecuaro, an important distributing center in the middle western state of Michoacan, is rushing work on a large hangar and is spending about $5,000 on the completion of the airport

Mexico Postpones Aviation Week

MEXICO CITY (MEXICO)—The national Aviation Week, which was to have been held Nov. 12-19 has been postponed to Dec 10-16 A general invitation has been issued all Mexican and foreign aeronautical interests to participate in the exposition, races, and demonstrations Mexican transport companies will allow a 10 per cent fare reduction to visitors to the celebration

R-101 Ready

VINDICATING THE CONFIDENCE of her designers and builders the R-101 made a successful test flight of 300 mi. on Oct 14 Although shorter than the Graf Zeppelin, the British dirigible is thicker and has a greater gas capacity, giving a greater useful load than any previous airship

Three French Firms to Merge

PARIS (FRANCE)—Three firms will be included in a merger which is being planned under the presidency of M. Nicause. The new firm will be known as Societe Generale Aeronautique and will include Societe Lorraine, manufacturers of airplane engines, Societe Anonyme Nieuport-Delage, producers of light passenger transports, and Avions R. Hanriot, builders of training planes. The capitalization of the combined firms will be about $80 000,000

French Air Committee Plans Safety Congress

PARIS (FRANCE)—An International Congress for Aerial Safety, to be held sometime in 1930 is being planned by the technical section of the French Committee for Aeronautical Progress. It would be the object of the congress to secure international cooperation in the furtherance for the plan outlined for France in 1926.

This plan intends (1) To improve the safety of gliders, by avoiding speed losses which are the cause of more than 60 per cent of the accidents and breakages during flights, which cause 5 to 6 per cent of the accidents (2) to assure the safety of the engines by reducing the number of breakdowns and fire risks; (3) to render the airways safer by the improvement of the signal system and knowledge of the routes followed (4) to make a thorough investigation of accidents in an endeavor to lessen their harmfulness by the use of parachutes and radio —[Information supplied by Department of Commerce —Ed]

Hanworth Club has 100 Students

LONDON (ENGLAND)—Unusual activity marked the first two weeks of operation of the Hanworth headquarters of National Flying Services, Ltd opened Aug 31 The ten DH Moths available were flown a total of 368 hr At least 100 students began their course of instruction, seventeen made solo flights, and nine qualified for "A" licenses In addition, nearly 4 000 mi were flown in air taxi operations although the Desoutter cabin monoplanes which are to be used regularly for this service were not available

P.A.A. Gets Argentine Contract

BUENOS AIRES (ARGENTINA)—On the eve of the first northbound flight over the Pan American and Pan American Grace Airways line from this city to Miami, Fla the latter firm received a 10-yr contract to carry mails from Argentina to Canada, Chile, Peru Ecuador, Colombia, Panama, Canal Zone, Costa Rica, Nicaragua, Honduras, British Honduras Cuba, Salvador, Guatemala, Mexico, Haiti Dominican Republic, Porto Rico Trinidad British Guiana Dutch Guiana

Foreign News Briefs

The Medal of Aeronautical Merit has been created in Mexico The first three of these medals go to Col. Pablo L. Sidar, now making a goodwill tour through Latin American countries in a Douglass machine, Col. Roberto Fierro, who made a goodwill tour of Cuba and Central America last year, and Gen. Juan F. Azcarate, designer of the Mexican plane bearing his name

Twenty four Italian Salvator type parachutes have been received for use of the Swiss air force

Cut rates of $2 50 and $5 for day and night flights, respectively, of 30 min. duration are to be offered the German public next year in a campaign to popularize flying

The advertising blimp of the Raab-Katzenstein works in Germany was wrecked in a recent severe wind storm

The flying clubs of Australia recently followed the lead of the Canadian clubs and organized the Associated Australian Aero Clubs

The French Committee for Aeronautical Propaganda plans to sponsor an International Congress for Aerial Safety next year

Press reports state that there is considerable agitation for the establishment of a British air transport system through the British possessions in the West Indies

Twenty Anahuac type planes, built in the Mexican government aircraft factory, are to be presented the School of Civil Aviation at Valbuena Field, Mexico City

It is expected now that more than 100 military and civilian pilots will participate in the flying events connected with Mexico's Aviation Week, Dec. 10-16

Societa Aerea Mediterranea has been organized to operate air services between Rome and Terranova and Cagliari, Sardinia Subsidy will be paid by the government on the basis of $1 30 for each mile flown.

The President of France has signed a decree creating an air police unit to enforce air traffic regulations Police planes will signal the offending pilot to land by releasing a black smoke signal

By decree of the Dominican Government, the air mail rate from Santo Domingo to Miami, Fla has been increased from ten to fifteen cents

Nine Dornier Wal flying boats, built in Holland under license, eleven Fokker reconnoitering planes and six Fokker bombing planes built at the Amsterdam Fokker works will be transported to the Dutch Navy base at Sourabaya Dutch East Indies, within the next few months

French air transport companies are issuing ticket books to the extent of 1,250 mi at about $55 per book, about $0 04 per mile

Light planes were included this year in the annual exhibition at Versailles

THE BUYER'S LOG BOOK

Ignition Shielding Equipment

ANNOUNCEMENT has been made by the Aircraft Radio Corporation of Boonton, N. J, of the development of a system of shielding for the ignition equipment of airplanes. This system was developed in co-operation with the Rome Wire Company and the American Bosch Magneto Corporation and may be applied to airplanes already built

The wiring harness is manufactured by the Rome Wire Company, and the plug shields are made by the American Bosch Magneto Corporation The plug shields are so constructed that they may be removed readily

Steel Shop Equipment

STEEL work benches tables desks, and similar shop equipment are offered in the "Hallowell" line manufactured by Standard Pressed Steel Company, Jenkintown, Pa. Interesting recent additions to the line are a steel shipping room table, provided with a variety of convenient accessories, a steel assembling table, with three tiers of shelves for shop pans, and a continuous steel work bench which can be furnished in any desired length, but which may also be taken apart if a number of individual benches are required These benches may be

Hallowell steel assembling table

provided with laminated planks in place of the steel tops

Other items in the Hallowell line are steel work tables, either on casters or for permanent installation; assembling tables, cafeteria tables steel desks for foremen, and for proofreaders, steel bench drawers, and a number of different designs of steel work benches The company also manufactures Hallowell steel shop equipment for other purposes, and steel floor trucks

Eversman Automatic Land Leveler

TIME and cost of leveling and maintaining dirt landing fields may be considerably reduced by the use of the Eversman automatic land leveler, a product developed by Eversman Manufacutring Company, Inc, 243 South Cherokee St, Denver, Colo. The new leveler is mounted on a steel frame 18 x 12 ft and its main

Automatic Leveler developed by the Eversman Company

feature is a blade which is so hinged to the wheels that it is raised or lowered automatically to remove humps and ridges or to distribute dirt in low places

The unit may be operated by one man and a tractor, and will level a 10 ft strip at a time. The set of the blade may be adjusted to permit the use of tractors of varying power Because of the automatic feature a uniformly level field is produced, instead of the way the field which is often left by the drags ordinarily used. The machine is also recommended to prepare dirt surfaces for oiling, paving or turf, as well as for keeping dirt fields in condition after they have first been leveled

TRADE CATALOGS

SILENT CHAIN An 85-page catalog containing a large number of illustrations and data on power transmission with silent chain drive has recently been published by the Ramsey Chain Company, Inc, Albany, N Y This publication, which is designated Industrial Catalog No 628 contains a number of dimension diagrams, tables and photographs bearing on the subject

PORTABLE ELECTRIC TOOLS Catalog No 2 recently published by the Millers Falls Company, Millers Falls, Mass is now available This twenty-three-page catalog contains a complete listing of electric drills and attachments, high-speed hole saws, portable sanders, hammers, screw drivers, grinders and other similar devices The catalog is 23 pages in length

REAMERS The Greenfield Tap & Die Corporation, Greenfield Mass, has recently issued a bulletin describing its "Reamrite" reamers and other tools Two general types are included the Reamrite hand adjustable reamer No 1128 and the piston line reamer No 1428

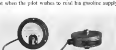
TOOLS The L S Starrett Company, Athol, Mass, has recently published a supplement to catalog No 24. This supplement called "New Tools," is included with the catalog The tools include gages, squares and rules

G. E. Gasoline Gage

AN ELECTRICALLY operated gasoline gage having no moving parts except the needle of the indicating instrument and the switch, is now offered by the General Electric Company, Schenectady, N Y This device depends for its operation on the hydrostatic head (pressure) of the gasoline to be measured. It can be used for one or several tanks

The device is essentially an electrically operated remote indicating pressure balance, the energy being supplied by the storage battery, dry cell or electric generator of the aircraft The installation consists of one or more pressure balance units, a remote indicating instrument which is actually a milli-ammeter calibrated in gallons, and having as many scales as there are separate tanks to be measured, and a normally open hand operated tumbler switch for each pressure balance. Every tank to be measured independently of the remainder of the ,gasoline supply requires a separate pressure balance, but where it is merely necessary to measure the total contents of a multi-tank airplane, one pressure balance alone will serve the purpose.

An important part of each installation is the tumbler switch. This device insures an open circuit at all times except when the pilot wishes to read his gasoline supply,



Pressure balance and indicator

thereby preventing unnecessary consumption of electric energy and overcoming any chance of fire from broken wiring in the event of a crash

The standard method of installing the pressure balances is to thread them into reinforcing plates welded to the under sides of the tanks If, however, one-unit systems are used in multi-tank planes, the single pressure balance is usually located at some point near the union of the various feeder pipe lines The indicating instrument and each tumbler switch are conveniently mounted on the pilot's instrument panel, and to complete the circuit it is only necessary to run a length of armored twin conductor wiring between pressure balances, tumbler switches, the indicating instrument and the electric supply

Each pressure balance weighs approximately 2 lb net a single indicating instrument weighs $5\frac{1}{2}$ oz, a tumbler switch weighs one ounce and the twin conductor wiring weighs about 0.32 oz. per ft Thus an ordinary one-unit installation weighs less than 3 lb

Binks Spraying Unit

IN RESPONSE to the demand for a general purpose spray painting and finishing outfit, the Binks Mfg. Company, 3114 Carroll Ave, Chicago, has placed on the market a device known as the Binks "New Hurley" unit This instrument is a complete unit equipped with a full sized quart, all metal container and a new Binks pressure cup spray gun applying an atomized flat spray 4 in in width

The air compressor unit is belt driven and connected to a $\frac{1}{4}$ hp General Electric motor This unit has a capacity of 2.16 cu ft of air per minute. The weight complete is 47 lb

The Binks new Hurley unit consists essentially of a rib cast iron air container mounted between the motor

The Binks "New Hurley" unit

and the compressor on a pressed metal base The entire unit is mounted on rubber feet Cylinder and base are cast in blocks of seasoned gray iron and accurately machined Ten feet of rubber covered electric cord, attachment plug and 10 ft of braided rubber air hose are attached to the outfit

Portable Electric Handsaw

ANNOUNCEMENT has been made by the Wodack Electric Tool Corporation 4627 West Huron St Chicago of a new model Wodack Junior Model K portable electric handsaw This tool may be used for cutting any board up to $2\frac{3}{8}$ in and weighs only 15 lb The unit is built complete, ready to use, and is furnished with a 15 ft extension cord, adjustable depth gauge and rip gauge, steel carrying case, grease gun and the necessary lubricant The device is fitted with a sawdust blower to provide vision and has a convenient trigger switch giving momentary contact A rip gauge saves marking the board to be sawed, and a depth gauge is provided.

Wodack Model K Saw

Shock Cord Package

SHOCK cord in a convenient and compact container known as the "Airport Package," is now being offered by the United Elastic Corporation, Easthampton Mass The Airport Package consists of a reel mounted in a wooden box in such a manner that the cord can be dispensed in lengths to the purchaser. Each package contains 250 ft. of shock cord Three general sizes, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{5}{8}$ in in diameter, are available

The shock cord in the Airport Package is made up of Para rubber thread lubricated and covered with standard Army and Navy Specification braid

WHAT OUR *Readers* SAY

Wood vs. Steel for Hangars

TO THE EDITOR

You were kind enough to furnish me with a copy of a letter from Mr M S Locke, of the Esline Company, who apparently does not entirely approve of my recently published article on the lumber built hangar.

Since Mr Locke is with a steel products company, his attitude is not unnatural. In any event, I had slight hope of convincing anyone with steel affiliations of the obvious superiority of wood for airplane hangars; however, let us consider some of Mr Locke's friendly comments on hangars

First, he implies that a better material than wood has been discovered for buildings For some purposes, certainly for the ever changing requirements of airplane hangars, certainly not You can't shut your eyes to obsolence Already some municipalities have had to move their airports and others are handicapped by million dollar investments in out-of-the-way fields

Next, Mr Locke says they have successfully and satisfactorily heated a steel building in Wisconsin for fifteen years. Well, it can be done, of course Then, he says, "Heating engineers grant our insulated sheet steel building heating properties equivalent to an 8 in solid brick wall" Note first that Mr Locke speaks of an "insulated" steel building. He must of course, insulate a sheet steel building or else give all his profits to the coal dealer If he uses enough insulation, heating can be effected satisfactorily altho his 8 in brick wall is scarcely as good as a wood wall with only exterior sheathing and siding The statement in my article referred to the uninsulated sheet metal siding construction

Mr Locke says ask me what the heating properties might be in a single wall wood hangar Presumably he means the lightest type of wood construction, i.e., wood siding directly over the studs, without any sheathing on either the outside or inside. Such a wall would have approximately twice the resistance to heat loss that a sheet metal wall would have and hence would cut the coal bill almost in half. If the walls are sheathed inside and outside, the advantage would be almost five to one in favor of wood over sheet steel

Next, speaking of costs, Mr Locke admits a 100 ft. x 100 ft lumber hangar can be built for $12 000 (and a most excellent type, too I might add) — but, he says, a steel hangar would not cost even one-half of $40,000 Well, that seems reasonable enough I mentioned $40 000 as the cost of a concrete and steel hangar, and was not considering such an investment in a sheet metal building

The next question is as to the portability and salvage value of the lumber-built hangar, in case a new hangar location becomes necessary At last we meet on a common ground. The point raised is an important advantage for both the lumber hangar and the light sheet metal building

Finally, Mr Locke mentions insurance rates. Ordinary frame construction, I believe, is generally given about the same rate as unprotected steel A bad fire would destroy either type, although wood trusses would probably stand up longer

Incidentally, it might be mentioned that engineers of the Lamella Roof Syndicate have perfected an economical design for an all-wood hangar employing sprinklered heavy-timber construction. Such a fire-resistant hangar will undoubtedly carry the same insurance rate as will a reinforced concrete hangar

N S PERKINS
National Lumber Manufacturers Association

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Air Racing and Stunting

TO THE EDITOR

May I say something about stunting, etc. at the Air Races? Having attended the majority of the meets and having had the pleasure of officiating as chief timer at the Air Classic of the Century, the 1929 National Air races, the suggestions that I make are given purely for the purpose of working out a scheme for holding races and eliminating any possibility of making the public afraid of aircraft

First and foremost there is no reason in the world why human endurance should be tested in airplanes or any other mechanical device And to do this testing in front of a grandstand filled with people whom you wish to become airminded is folly indeed The death of Jack Reid at this year's show was an example And lucky enough it happened at night when spectators were asleep, and away from the field where the wreckage did not bring horror to the minds of those attending. His new record established and honors won at one o'clock in the morning, he should have been forced to come down at once One of my timers reported that when last observed he was passing over the observation hangar racing his motor then slowing it down, alternating the throttle back and forth in an effort to keep awake Assurance that "Jack will never go asleep He's been at the game too long (15 years I believe)" was of no avail for only a few minutes later Jack was asleep—for good Plainly a case of the human element failing—the body refusing to function normally—sleep overcoming the will power of Jack Reid

The only reason that stunting and parachute jumping (fortunately none of the crazy delayed chute drops were included this year) are placed on the program of air racing is to amuse the crowd and retain their interest between races The races themselves have always been more or less just a bunch of planes going around a pylon and no one knew who won until the figures came from the timers' box Right here is where some remedy is needed. Cy Caldwell suggested that we use what he terms as the "Race horse start" That is for all the planes to start off at once and go out to a scattering pylon located ten miles out and then race for the home pylon—the real race starting, as far as timing was concerned at the time they crossed the starting line on their trip in from the outside pylon We were supposed to use that method this year But somehow or other it was washed out as the starter could not get the pilots to agree to undertake the new idea Consequently the races were run as per usual with no one knowing a thing about the results until they were announced And this method is certainly anything but entertaining to the public watching the race

The five-mile course for racing is plenty big On days when it is clear all the pylons can be seen in plain view of the stands People can watch, with ease, four planes racing around such a triangular course and can observe their favorite plane gaining or losing ground speed between the two pylons located farthest away And on the home stretch can see perfectly any change in position of the racers Thrills and plenty of them come for the average man watching a race when the turns are made around the pylon, and if there are good flyers racing who will obey rules, there will be plenty of thrills without damage to man or plane So here's my suggestion for racing airplanes

If there are twelve planes entered in the race of say ten laps of five miles each, let's put the race on in this manner Four planes will race the first heat The first heat will be two laps of five miles each All four will take off at once and their starting positions will be assigned them as in horse racing The crowd can then see who wins the heat and his plane will be brought up to the starting line for the finals The winner of the second and third heat will do likewise and after the heat winners are known then interest is created which will make the finals really interesting Even to

wagering, if you please, and when you can wager on the outcome of anything, that is a criterion of interest creation This method will consume time but it will fill a program with thrilling stunts and will tend to develop good race pilots as good jockeys are developed

The crowds at the National Races of 1929 were at a loss to know who was racing or what race was being run with the exception of a few races which were correctly stated by the announcer and even he apologized to the crowds by saying 'I'll tell you who's in ship 125 in just a few minutes as soon as somebody tells me etc" A scoreboard with the race that is coming next, the ship's entry and the pilot's name could be placed in full view of everyone If only four planes were running this would be easy It was impossible this year, for in one race eighteen army planes, all with the numbers that the army gave them, raced in one race at one time—the five mile course and ten times around, and 90 per cent of the spectators (including myself) were glad when the thing was over The crowds were more eager to see the Waco stunt team perform and they were next on the program

Qualifying trials are interesting to the public providing they know who is doing the qualifying etc In racing as I have suggested these separate heats would amount to the same thing as qualifying trials but with interest added The loudspeaker system and the announcers at this year's show were the best ever and a necessity without which the show would not have been so pleasing from the spectator's standpoint, but it can never supplant the scoreboard which is in plain view all the time and can be seen at any time a person desires to look its way It is impossible to remember pilot's names and plane's names just from hearing it once or twice on the radio loudspeaker The pilots, too, would be better satisfied with this arrangement, because it would give them more publicity as the public would learn to know them better and remember their ships more vividly Every pilot before each heat should be introduced via loudspeaker and this adds too to the interest

Every year the races get better and better Cleveland had a wonderful program of events and enjoyed wonderful weather, and the officials who put on the show are to be congratulated for such a wonderful aeronautical exhibition However, as the years go by, I hope that less stunting and human endurance tests will be included, and that interesting races can be put on that will draw the crowds just as well and that thereby, the air-traveling public will be increased I would like to see more in your very interesting magazine about air racing

Dr Don Crawford.

[The similarity between Dr Crawford's views on racing and those expressed in the article by Edward P Warner in Aviation for September 28th is striking It should be pointed out that the coincidence of opinion was completely independent as Dr Crawford's letter was received in this office after Mr Warner's manuscript was written, but before it was published —Ed]

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Observations of a Private Owner

To The Editor

I am in my early sixties I've been flying for ten years. I fly for the love of flying

I began with Aeromarine 40 flying boats bought from Navy surplus supply while Hon Franklin D Roosevelt still was Assistant Secretary of the Navy Later I played in open cockpit planes Some months since I bought a four place Stinson cabin monoplane with a J-5 Wright engine My longest single trip eight hundred miles, perhaps

A few days ago, I made a bad landing, bumped my head on a steel brace, was knocked unconscious lost control of the plane, and it promptly flopped over on its back. Neither pilot nor plane was badly damaged. My only accident in ten years. Shame

With a propeller setting giving about 1,900 r p m., my usual practice is to throttle to about 1,650 when I am up, i e about 95 miles per hour Usually I am in no hurry to go anywhere, and at this speed the engine is running smoothly, and so nearly quiet that conversation in the cabin is quite easy

From this flying experience plus observation, I have drawn these conclusions:

If you really love flying—love the feel of the plane as it responds to perfect co ordination of aileron and rudder then you can learn to fly, no matter how old you are

But to make a good pilot one should fly every day It is far more necessary than driving an automobile every day to make a good chauffeur The very speed of the plane requires more alertness quicker decisions, and unerring judgments.

Three things are required in comfortable flying for those like myself who fly for the enjoyment of it namely, (1) a dependable engine (these are available) (2) an inherently stable plane (easily obtainable) and (3) suitable landing field surfaces Of the latter there is not one in a dozen fields. Witness the record of damaged planes and wrecked landing trucks in a year No sane owner would drive his automobile fifty miles an hour over the average landing field But that is the punishment many an airplane is subject to.

In June I landed in a field which had the weeds cut in two right-angle runways I chose the one into the wind although it was over high-tension power wires When the plane stopped rolling the wheels were in mud up to the axles A tractor was required to haul me out It was advertised as a "hundred-acre flying field."

Yesterday's airplanes were built for the pilot; today they are built for the transport companies; tomorrow they will be built for the man accustomed to the finish and comfort of a limousine. He has the money, wants the best and can afford it And the best will include landing fields which will not put himself or his plane in jeopardy. So I am sure we will soon have fine landing fields at most of the large cities, with runways like city streets, for men of affairs have a way of getting things done.

Which brings me to an angle of flying that I have not seen stressed Usually the airplane's speed is spoken of as the sole reason for its existence. But to me its greatest attraction is the wonderful roadway available, in every direction; no waiting for a right-of-way, or grading or bridges, and always the shortest distance between here and there

With universally good landing fields we will all be accepting the air lanes of tomorrow as commonplace and begin to really appreciate them, winging our way in any direction with confidence.

C. Francis Jenkins,
Washington D C

[Mr. Jenkins is known to most of our readers as a great authority on television and as a pioneer inventor of moving picture equipment Although never connected with the aeronautical industry he has, as his letter shows, enthusiastically followed flying as an avocation —Ed]

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Helium and the Government

To the Editor:

Not only our president, Mr Girdler, but all of us in our organization appreciate unusually the sound editorial in Aviation of September 14

This subject of helium gas is a sore one with us We are in the difficult and almost impossible position of being compelled to compete with the United States Government in developing an industry for whose output the government is the only present large user We feel that this editorial in Aviation for the first time states the facts as they are and indicates the solution as it should be Naturally we are inclined to be prejudiced because it is our company and our industry at stake and for this reason we are doubly pleased to find a magazine of standing, explain editorially in so straightforward a manner the situation as it actually exists

E. G. Luening
Vice-President
The Helium Company,
Louisville, Kentucky

AVIATION
The Oldest American Aeronautical Magazine

October 19, 1929

AERONAUTICAL ENGINEERING SECTION

CONTENTS

THE PRODUCTION OF

Lift BY *Propeller Blades*

By MAX M. MUNK, Dr. Eng., Ph. D.
Alexander Aircraft Corporation

AN analysis of propeller model tests undertaken by the author several years ago[1] confirmed in general the established views about the action of propeller blades, but showed these principles to be unsatisfactory for the numerical computation of the thrust developed It was concluded that there existed a large and consistent discrepancy between the thrust observed and the thrust computed regarding the blades as wings the propeller thrust being actually larger than expected This conclusion is not stated in the mentioned paper, but was reached after the paper had gone to print Indeed, the paper contains just the opposite conclusion, viz, the statement that the thrust computed and the thrust observed do agree This latter conclusion was however reached in error and is wrong The lift created by a propeller blade element and the lift created by the same element when a portion of an ordinary airfoil differ consideraby from each other It is of scientific interest and of practical value to become clear about the nature of this difference and to find an explanation for it The author has found such an explanation, and offers it in this article to the public, together with some wind tunnel experiments undertaken to support it They fully do so Further studies of the question seem nevertheless highly desirable and necessary before the explanation can be considered as definitely established, and can be used for direct practical application

Before proceeding to the explanation itself it is necessary to discuss the nature of the discrepancy requiring such explanation, and to show reason why such discrepancy became apparent subsequent to the publication of an analysis of propeller test data when it was not at the time when this analysis was made This latter was the consequence of a simple oversight In the analysis, the action of all propeller blade elements was summarily replaced by the action of one such element, of suitable area, supposed to be located at the point of average action Now, the blade elements far away from the propeller axis have a relatively large velocity of motion through the air and therefore contribute relatively more to the creation of thrust than the blade elements near the propeller axis In consequence, the center of creation of thrust is not located at a point half the propeller radius but farther out probably near 70 per cent of the propeller radius Seventy per cent is a good assumption for this center of creation of thrust, meaning that if we assume all propeller elements to create their lift under the same conditions and particularly with the same velocity as the element at 70 per cent propeller radius, rather than under their actual conditions, we shall obtain by computation a thrust and torque close to the actual thrust and torque of the propeller Such a position of the center of thrust at or near 70 per cent is indeed generally employed for preliminary computations

THE OVERSIGHT referred to consisted in applying this 70 per cent not only to the choice of the center of thrust (which is about correct) but also to the center of increase of thrust with increase of r.p.m. (which is wrong) Suppose the propeller to rotate with a certain r.p.m and to move at the same time with a certain flight velocity A creation of thrust by all blade elements takes place different in general at all of them, and more intense far from the axis than close to it, giving rise to the location of the center of application of the resultant total thrust of one blade at about 70 per cent under average conditions Now suppose the velocity of flight to be kept unaltered, but the r.p.m. to be increased by a small amount All blade elements create now a larger thrust (in general) and we focus our attention on the difference of the new thrust after the increase of the r.p.m and before the r.p.m were increased We are at first inclined to expect the elements near the propeller tip to experience larger differences of thrust than the elements near the hub both with the same area of course, for now as before the tangential velocities are larger and so are the increases of this velocity This argument, however, is now misleading The increase of lift is governed not only by the increase of velocity, but also by the increase of the angle of attack of the blade elements This increase of the angle of attack when increasing the r.p.m is likewise different at the different blade elements, but in a way opposite to velocity variation. A closer examination of the geometrical relations shows that the increase of the angle of attack is larger near the hub than it is near the tip In consequence the difference of effect on the blade elements for an increase of the r.p.m. due to velocity variation is wiped out, and this effect is evenly distributed along the entire propeller blade When speeding up a propeller, the center of the thrust elements added does not coincide with the center of the thrust itself The latter is near 70 per cent, but the former has to be assumed near the center of the blade, near 50 per cent of the propeller radius

The mathematical demonstration of these relations requires some geometry and calculus These relations

[1] *Max M Munk Analysis of Durand & Lesley's Propeller Tests, N A C A Technical Report No 175*

are already given in the author's book[2] on aerodynamics, to which we refer the reader who wants to check personally this piece of mathematical deduction The others may accept it on faith

The reader may by now have guessed the error committed in the original analysis of propeller tests The 70 per cent was taken erroneously for both the center of thrust and the center of increase of thrust, whereas the latter should have been taken at 50 per cent This error resulted in the assumption of too high a velocity for the computation of the increase of thrust, and hence in the computation of too high a thrust which seemed well to agree with the thrust observed Replacing the summary computation, by the computation of the thrust of all blade elements, and summing up these results revealed the error committed.

The propeller analysis repeatedly referred to was performed by plotting the thrust coefficient against the computed average slipstream velocity, divided by the flight velocity Fig 1 shows three curves obtained in that way These curves are particularly suitable for the analysis because they are straight lines It is the discovery of such new curves that constitutes scientific progress the progress consisting not in obtaining a new curve, which can be done easily but in obtaining a straight line where formerly a more complicated curve was found

The slip curve, practically straight obtained in the indicated way, stands in a close relation to the ordinary lift curve of a wing section, obtained by plotting the lift coefficient against the angle of attack Both are straight and the slope of either can be used for the computation of the slope of that theoretical lift curve referring to a wing of infinite aspect ratio. Proper allowance has to be made for the induced downwash, in the one case, and for the slipstream velocity, in the case of the propeller Both computations require only the knowledge of the geometrical dimensions of either the wing or the propeller, they are easily performed and are explained in detail in the paper and book of the author referred to

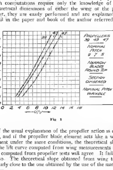

Fig 1

If the usual explanation of the propeller action is correct, and if the propeller blade element acts like a wing element under the same conditions, the theoretical slope of the lift curve computed from wing measurements and that computed from propeller tests will agree It fails to do so The theoretical slope obtained from wing tests is fairly close to the one obtained by the use of the mathematical theory only It is about 10 per cent smaller, meaning that a wing produces about 10 per cent less lift than would be expected from merely theoretical arguments This is a good agreement in view of the differences between the assumptions of the pure theory and the actual conditions these differences being in favor of a diminished lift The slope obtained from propeller tests, however, is consistently greater than the theoretical slope, and even more so than the slope obtained from wing tests It is about 30 per cent larger than the theoretical slope and 40 per cent larger than the wing slope This means that propeller blade elements create a lift larger than would be expected from either wing experiments or theory We would be willing to abide with too small a lift, assuming that the friction of the air

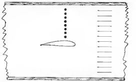

Fig 2

diminishes the lift of propellers even more than it diminished the lift of wings No such arguments can be brought in favor of an excess of lift however, but it must be concluded that the conditions under which the blade elements work are distinctly different from the conditions of the same elements acting as parts of airfoils

This point is important The different conditions are not even likely to confine their effect to the lift only All other characteristics may be affected likewise such as the drag and the maximum lift coefficient We are confronted with the discovery that we know less about propeller sections than we thought we knew In the light of the discovered discrepancy, we must become distrustful towards ordinary wind tunnel wing tests as far as their application to propeller sections is concerned Something particular happens to propeller elements that is not found at present with wind tunnel airfoil tests It may be possible that this particular condition gives a good propeller section if the same section is had as a wing section and vice versa We have to start the research referring to propeller sections anew and we do not even know the proper way to do this except the obvious but difficult one to build propellers and try them If we knew the explanation for the discrepancy between the lift of wings and propeller blades we might devise a way to create the particular propeller condition in wind tunnel work It may be possible to modify the wind tunnel so as to obtain the same conditions as are existing with propeller blades running thus special airfoil tests in an air flow imitating the conditions around propeller blades These thoughts and arguments it is hoped will arouse in the reader the right appreciation of the significance and importance of the explanation we are going to

[2] *Max M Munk Fundamentals of Fluid Dynamics for Aircraft Designers, Page 113*

offer, and fill him with the interest and curiosity it deserves.

While studying the question of slope of the lift curve of wings and of the lift curve of propellers, the author realized early that another curious fact was probably closely connected with it. This is the break in the

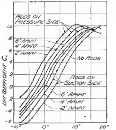

Fig 3

slip curves of most propellers. The slip curve is a straight line for small values of the thrust only. When a certain thrust is reached, there occurs generally a break in the slip curve and this curve continues at a different slope. This would not be strange if the slope at large thrust were smaller than at small thrust, otherwise expressed if the thrust produced at large values were lacking to a higher degree than at small values. Just the opposite occurs. At large values of the thrust coefficient, the slip curve becomes more or less suddenly steeper, meaning that the thrust, already unexpectedly large under ordinary conditions, becomes even more so if the thrust coefficient is near its upper value. The slope at small thrust coefficients is the one used by us for the computation of the theoretical slope, otherwise the discrepancy would become even more pronounced. The combination of these two different facts does not in itself give the explanation wanted but it furnishes a criterion for the correctness of any explanation offered, as such explanation should explain both unexpected facts rather than only one.

After long studies the author arrived at last at an explanation which satisfies this requirement and appeals to common sense. It is probably the lack of uniformity in the velocity of the air in the vicinity of propeller blades that causes the creation of the excess lift. In a wind tunnel, the air velocity is equal at all points except for the action of the wing itself. Not so with a propeller. The propeller blades are working in a slipstream which is in the process of being formed. It is contracted near the propeller, gaining velocity parallel to the propeller axis. It is further gaining rotational velocity at right angle to the propeller axis. As a consequence of the latter, the velocity at the suction side (top) of the propeller section is larger than the velocity on the pressure side (bottom) of the propeller section regardless of the propeller blade's own action. The author believes that it is this lack of uniformity of the air velocity that gives rise to the excess lift, and finds this belief strengthened by three independent facts which can be explained and by model tests made to throw light on the effect of lack of uniformity of velocity distribution on the creation of lift of airfoils.

For these tests, the author is indebted to Dr. A. F. Zahm, in charge of the wind tunnel of the Washington Navy Yard, for having the tests performed, and to the authorities of the Navy for giving permission to use the wind tunnel for this purpose. As it was too difficult to have the velocity in the wind tunnel uniformly changed, we confined ourselves to changing it in an irregular way. As shown in Fig. 2, a number of round rods one-quarter of an inch in diameter were placed crosswise to the tunnel air flow, parallel to the wing span, forming a grating of constant spacing. There were such rods on one side only, either on top of the airfoil or on its bottom. The tests were made with two different airfoils, and gratings with different spacing were used. For comparison's sake the tests were also run the ordinary way in a uniform airflow without any grating.

The results are given in the diagrams Figs. 3 and 4, and show a very marked effect of the rods on the lift produced. These diagrams give the ordinary lift curves, the lift coefficient plotted against the angle of attack, with the different gratings in place. One and the same grating has no appreciable effect on the slope of each lift curve, but it changes the lift itself markedly. The different lift curves are consistently displaced. The grating on the bottom of the wing section increases the

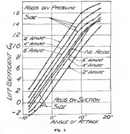

Fig. 4

lift, and a close grating is more effective in this respect than a wide grating. The grating on the top side of the section, on its curved suction side, decreases the lift. A similar effect, by the way, was observed with wing models in the presence of propellers in certain tests made in the Goettingen wind tunnel. The propeller in

front of the upper side of the wing increases its lift, the propeller below it decreases it. This effect is not very pronounced, as the propeller is in front of a small portion of the span only, but still it is distinct. The result of our model tests furnish a satisfactory explanation of the change of the slope of the lift curve of propellers, although in the tests the slope remains practically unchanged. The conditions around a propeller vary for different thrust coefficients, the rotation of the slipstream being larger at large thrusts. Hence the different points of the propeller lift curve are equivalent to points located on the several curves of Figs. 3 and 4, which, when connected, have a slope different from the slope of the individual curves.

We proceed to the break in the slip curve of propellers. Following the line of thought adopted, this would be explained by a sudden increase of the rotational velocity of the slipstream. This again would

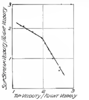

Fig. 5

require a sudden increase of drag of the propeller blades, resulting in a larger torque. This now is exactly what we would expect if the thrust increases to a large value. Portions of the propeller blade are then reaching their burble points and experience large increases of drag. This gives a large torque and a large rotational velocity of the slipstream.

We conclude our paper with the discussion of a very distinct check on the explanation offered. Windmills are similar to propellers in their aerodynamic action, but the direction of thrust and torque is reversed with them. The same arguments as used before for propellers apply to windmills also, but they lead to the expectation that for windmills the slope of the slip curve is smaller than indicated by the simple theory, and that the break in the slip curve is opposite in direction to that for propellers, the slope decreasing rather than increasing beyond the break. The author finds only one such windmill test available, made by himself many years ago and published in 1923.[3] The slip curve was not drawn at that time, but was drawn only recently after the above conclusions were reached. The curve confirms these conclusions fully, and in so far as the conclusions were reached first, it can be said that these unusual features were foreseen and predicted by the use of the explanation for excess lift of airplane propeller blades which forms the subject matter of the present paper.

It is up to those actively engaged in aerodynamic research to enter the proposed way of attacking the propeller problem. Their efforts are required for making the preceding discussion fruitful for the progress of the science and for obtaining better and more efficient propellers through its help.

[3] Max M. Munk, Wind Driven Propellers, N.A.C.A. Technical Note No. 201.

PATENTS ISSUED

Patent No. 1,725,950—Airplane. Karl Robert Ernst Badermann, Sagon, Germany. Five Claims.

Patent No. 1,726,468—Aeroplane. Maurice H. Block, Brooklyn, N. Y. Seven Claims.

Patent No. 1,726,558—Airplane. Randolph F. Hall, Ithaca, N. Y. Three Claims.

Patent No. 1,726,783 — Aircraft-Elevating Means. Eugene VanNate, New York, N. Y. Four Claims.

Patent No. 1,727,033—Aircraft. Roy W. James, Covina, Calif. Nineteen Claims.

Patent No. 1,726,981—Aircraft. Anthony Herman Gerard Fokker, Amsterdam, Netherlands. Eighteen Claims.

Patent No. 1,727,014—Aircraft. Andrew A. Kucher, Chester, Pa. Five Claims.

Patent No. 1,727,047—Aeroplane. Edward M. Burchell, San Jose, Calif. Three Claims.

Patent No. 1,727,077—Landing Gear for Aircraft. Frank Henry Orddige, Ruislip, and David Leonard Hollis Williams, Ickenham, England, assignors to Charles Richard Fairey, Hayes, England. Four Claims.

Patent No. 1,727,157—Aeroplane Safety Device. Louis Blumenthal, Brooklyn, N. Y. Three Claims.

Patent No. 1,727,275—Airplane Stabilizer. Frederico G. Diaga, Havana, Cuba. Eight Claims.

Patent No. 1,727,051 — Two-Cycle Airplane Engine. John W. Davis, Washington, D. C. Eight Claims.

Patent No. 1,727,379—Parachute. Benjamin L. Elliott, Brown County, Ohio. Two Claims.

Patent No. 1,727,310—Load-Factor Indicator for Aircraft. Wolfgang Klemperer, Akron, Ohio. One Claim.

Thirty-one Designs Receive Department A.T.C.

During the period of September 22 to October 19, 31 designs have received Airworthiness Type Certificates issued by the Aeronautics Branch, Department of Commerce. The addition of the newly licensed planes brings the total of licensed planes up to 253. The designs granted certificates during the 30 day period are products of Fokker, Curtiss Simplex, Brunner-Winkle, Waco, Moreland, Fairchild, Cessna, Bellanca, Ford, Doyle, Ireland, Mona, Stearman, Lockheed, Swallow, Kreutzer, New Stand, Great Lakes, General, Nicholas Beazley, Rearwin and Command Aire. Complete specifications of new designs will be found in the supplement of the Aeronautical Engineering Section.

Weight Control

IN THE DESIGN OF AIRCRAFT

By Fredric Flader
Consolidated Aircraft Corp.

PART II

The following tabulations represent a fairly complete compilation of weight information on the parts and materials which go into the construction of an aircraft. The weights of engines are not included as these weights may be found tabulated up to date in current issues of Aviation.

With the use of these data and the procedure outlined above the uncertainties in regard to weight in aircraft design can be eliminated

Plymouth, Mahogany	Approx Weight Lbs per Sq Ft
[illegible]—3 ply	22
[illegible]—3 ply	21
[illegible]—3 ply	29
[illegible]—3 ply	53
[illegible]—5 ply	27

Liquids	Lbs. per Gal.
Gasoline	5 9—6
Oil	7 5
Water (Fresh)	8 2
Water (Salt)	8 5

Size Copper—Sheet	Lbs per Sq Ft
18 oz (015)	625
14 oz (019)	875
16 oz (021)	1 000
20 oz (027)	1 250
24 oz (032)	1 500

Miscellaneous	Lbs per Cu In
Asbestos (Sheet)	090
Celluloid	051
Felt	035
Glass	090
Leather	031
Rubber	040— 065

Materials

Metals	Lbs per Cu In	Wood	Lbs per Cu Ft
Aluminum (Cast)	0924	Ash—White Fraxinus Americana	41
Aluminum (Rolled)	0978	Balsa, Ochroma lagopus	10
Aluminum Alloy (Duralumin)	1012	Mahogany, Central American	24
Brass	3075	Maple, Hard (Sugar)	44
Cadmium	3107	Pine, White	26
Chromium	2457	Spruce, Eastern	27
Copper	3212	Spruce, Sitka (Western)	27
Iron	2634	Cork	15
Iron (Cast)	2605	Felsa	8 5
Iron (Wrought)	2779	Basswood Tilia Americana	26
Lead	4108	Birch, Betula Sp.	44
Magnesium	0628	Cherry, Black (Prunus Serotina)	36
Manganese	2890	Hickory, Hickora Sp.	51
Mercury	4900		
Nickel	3170		
Silver	3805		
Steel	2839		
Tin	2634		
Vanadium	1087		
Zinc	2598		

WIRE

Gauge	Steel Spring Wire	Brass Wire and Phosphor Bronze Spring Wire	Iron Wire	Copper Wire
No 24 (020)	0021	0035	00107	
No 21 (028)			00271	
No 20 (032)	0042	0047	0043	00482
No 18 (040)	0129	0122		
No 16 (051)	0173	0185		
No 14 (064)	0279	0308		
No 8 (128)	0442	0487		

Wire—Aluminum Alloy Size	Wt per Foot
03125	0008
0625	0037
09375	008
125	015
156	022
187	025
250	060
212	082
575	136

Wire—Spring Flat Steel Gauge B W G	Lbs per Sq Ft
No 20 (035)	1 428
No 18 (0481)	1 099
No 16 (065)	2 652

Wire—Brass Mesh		Lbs per Sq Ft
22 Mesh per in	015 wire	240
22 Mesh per in	007 wire	110
110 Mesh per in.	004 wire	142

TUBING—STEEL

Weight in Pounds per Linear Foot
B W G

Outside Diameter	No 24 (022)	No 22 (028)	No 20 (035)	No 19 (042)	No 18 (049)	No 17 (058)	No 16 (065)	No 15 (.072)	No 14 (083)	No 12 (.109)	No 11 (.120)	[illegible] (188)	[illegible] (250)
[illegible]	058	048	057										
[illegible]	054	066	080		105								
[illegible]	071	086	104		138	157							
[illegible]	082	102	127		170	196							
[illegible]		141	174	206	236	274							
[illegible]		170	221	262	302	351							
[illegible]		216	267	216	367	420							
[illegible]			314	372	432	506							
[illegible]			361	450	498	584							
[illegible]			407	496	565	661							
[illegible]			454	542	629	750	822						
[illegible]			504	588	694	816	906						
[illegible]			549	654	750	882	996		1 255	1 424	1 767	2 928	
[illegible]					625	971	1 085						
[illegible]									1 422				
[illegible]					880	1 046	1 170		1 476	1 492	2 089		
[illegible]					956	1 126	1 257						
2			.235		1 021	1 202	1 343		1 607	1 951	2 007		
[illegible]						1 280	1 430						
[illegible]											2 657		
[illegible]						1 258	1 517	1 675	1 919	2 184	2 750	4 130	
[illegible]						1 436	1 604	1 771			2 808		
[illegible]							1 691	1 867	2 142	2 430	2 050		
[illegible]									2 252		2 210		
[illegible]									2 216			5 032	
[illegible]							1 882		2 564	2 681	5 571		6 676
[illegible]									2 475		3 531		7 010
3									2 588		3 901		
[illegible]												6 041	
[illegible]											4 011		8 010

SHEET—STEEL

Gauge (B W G)	Lbs per Sq Ft
No 24 (022)	898
No 22 (028)	1 142
No 20 (035)	1 428
No 18 (049)	1 999
No 16 (065)	2 652
No [illegible] (100)	4 080
No [illegible] (125)	5 100
No [illegible] (187)	7 650
No [illegible] (250)	10 200

PLATE—TERNE AND TIN

Thickness (B W G)	Lbs per Sq Ft Terne Plate	Tin Plate
No 26 (018)	72	
No 24 (022)	88	88
No 28 (015)	41	

SHEET—ALUM ALLOY—ALUMINUM—BRASS

Gauge B & S	Weight Lbs per Sq Ft—Aluminum Alloy Sheet	Aluminum Sheet	Brass Sheet
No 27 (014)	206		
No 25 (018)	261		
No 22 (025)	321		
No 21 (028)	410		
No 20 (032)	463	4501	1 415
No 19 (036)	522		
No 18 (040)	582	5676	1 785
No 17 (045)	652		
No 16 (051)	739	7150	2 251
No 14 (064)	925	9026	2 838
No 12 (081)	1 189		
No 11 (091)	1 451		
[illegible] (125)	1 815		
[illegible] (188)	2 722		
[illegible] (250)	3 625		

FIBER—SHEET ROD AND TUBING

Sheet Thickness	Lbs per Sq Ft—Phenol Fiber Sheet (Black Plate)	Fiber Sheet (Hard)
[illegible]		23
[illegible]		45
[illegible]	85	91
[illegible]	1 28	1 37
[illegible]	1 70	1 82
[illegible]	2 55	2 72
[illegible]	3 40	3 64
[illegible]		4 55
[illegible]		5 46
[illegible]	6 80	7 26
2	20 40	

Rod—Hard Fiber Diameter	Lbs per Foot
[illegible]	067
[illegible]	110
[illegible]	186
[illegible]	268
[illegible]	264
1	476
[illegible]	744
[illegible]	1 071
[illegible]	1 460
2	1 909

Tubing—Hard Fiber Diameter—Outside	Inside	Lbs per Foot
[illegible]	[illegible]	017
[illegible]	[illegible]	021
[illegible]	[illegible]	149
[illegible]	[illegible]	051
1	[illegible]	058
1	[illegible]	292
[illegible]	1	127
[illegible]	[illegible]	142
[illegible]	4	990

ROD AND BAR—STEEL—ALUM ALLOY—ALUMINUM—BRASS—ROUND AND HEXAGONAL

Size	Steel Round	Steel Hex	Aluminum Alloy Round	Aluminum Alloy Hex	Aluminum Round	Brass Round
[illegible]	042		015		014	0453
[illegible]	094		034		030	1011
[illegible]	167		061	067		
[illegible]	260	288	094	104		
[illegible]	375	414	136	150	129	4074
[illegible]	511	564		205		
[illegible]	667	727	242	268	230	7245
[illegible]	845	952		234		
[illegible]	1 043			418		
[illegible]	1 262	1 382		505		
[illegible]	1 502	1 658	545	601	518	1 650
[illegible]	2 044			820		
[illegible]	2 547	2 501		842		
[illegible]	2 670		970	1 068	921	2 867
[illegible]	3 414	2 227		1 195		
[illegible]	4 175	4 063	1 515	1 670	1 450	4 527
[illegible]	5 510	6 091		2 170		
[illegible]	6 900		2 195		2 072	6 510
[illegible]	10 720		3 870		3 692	11 59
[illegible]	16 640		6 080		5 759	18 11
[illegible]	25 07		8 726		8 287	25 08
[illegible]	22 09		10 875		11 380	25 40
[illegible]	42 65					

TIE RODS AND TERMINALS

Weight of Tie Rods per Inch

Size	Rated Strength	Overall Length—Streamline	Round	Weight of Rigid Terminals
6—40	1,000	026	020	015
10—32	2,100	046	051	025
[illegible]—28	3,400	063	068	050
[illegible]—24	6,100	127	141	090
[illegible]—24	8,000	205	205	104
[illegible]—20	11,500	286	300	165
[illegible]—20	15,500	375	350	220
[illegible]—18	20,200	490		
[illegible]—18	24,700	606		

TURNBUCKLE—ASSEMBLIES

Rated Strength	Cable Eye and Fork Short	Long	Cable Eye and Pin Eye Short	Long	Cable Eye Short	Long
800	021		020		050	
1,600	062	068	064	064	064	061
2,100	080	112	084	116	082	114
2,800	112	172	112	172	110	170
4,600	160	245	165	250	160	245
6,100		345		360		362
8,000		415		426		418
12,500		626		620		625
17,500		825		855		820

MATERIAL—MISCELLANEOUS

Celluloid — [illegible] in thickness, .47 lbs per sq ft; Triplex—2 15 lbs per sq ft

Glass — Safetee—Super quality [illegible] to [illegible] thick 2 5 lb approx wt per sq ft; Safetee—Plate quality [illegible] to [illegible] thick, 4 lb approx wt per sq ft; Safetee—Special quality [illegible] to [illegible] thick, 4 lb approx wt per sq ft

Artificial leather — Upholstering material, 16 lb. per sq ft.

Gimp artificial leather Width	Lbs per Ft
[illegible]	0148
[illegible]	0188

Felt Thickness	Lbs per Sq Ft
[illegible]	28
[illegible]	57
[illegible]	1 14

Leather genuine — 16 lbs per sq ft 12 to 17a lbs per sq ft.

Webbing linen Width	Strength	Weight Per Foot
[illegible]	2800	064
[illegible]	750	032

Fabric — Mercerized Cotton Airplane Fabric Grade A .021 lbs per sq ft

Canvas — Designation as per Trade Name	22 In. Wide Wt Lbs per Sq Ft
Ravens 0	080
Ravens 0	091
Sag [illegible]	170
Ravens 8	091

Tape	Width	Weight, Lbs. per Ft
Cotton-herringbone selvage edges		0010
		0024
		0030
Pinked edge grade A cotton		0055
Plain grade A cotton		0030
Silk—Japanese	36 in wide 1 4 to 1 6 oz per yard.	

	Tensile Strength Lbs.	Weight Lbs per Ft
Silk Cord—Braided	100	0012
Twisted Cord	250	0040

THIMBLES

Cable Diameter	Approximate Weight Lbs
[illegible]	002
[illegible]	004
[illegible]	0065
[illegible]	009
[illegible]	0145
[illegible]	0162
[illegible]	0262
[illegible]	0285
[illegible]	0770
[illegible]	12
[illegible]	14
[illegible]	17
[illegible]	21
[illegible]	28
[illegible]	33
[illegible]	66
[illegible]	99

PINS—FLATHEAD (Clevis)

Size	Wt per Inch Overall Length
[illegible]	0025
[illegible]	008
[illegible]	015
[illegible]	021
[illegible]	042
[illegible]	056
[illegible]	070
[illegible]	087

PINS—TAPER

Size	Wt per Linear Inch
00	0042
0	0051
1	0060
2	0072
3	0085
4	012
5	016
6	024

SHACKLES

Shackle and Cable Strength	Weight Lbs
800	021
1 600	022
2 100	022
3 200	030
4 600	070
6 100	090
8 000	090
12,500	250
17,500	260

STRAND AND CABLE—STANDARD

Non-Flexible 19 Strand Steel	Extra-Flexible 7 x 19 Cable Steel	Weight Per Foot
[illegible] (078)		0121
[illegible] (109)		026
[illegible] (125)	[illegible] (125)	0259
		0464
[illegible] (156)	[illegible] (156)	035
	[illegible] (187)	0647
[illegible] (187)		077
[illegible] (219)		100
[illegible] (250)		135
[illegible] (312)		2065
[illegible] (375)		2976

ROPE—STEEL WIRE

Size	Breaking Strength	Pounds per Foot
[illegible]	4690	18
[illegible]	7020	15
[illegible]	10500	22
[illegible]	14000	30
[illegible]	18200	39
[illegible]	23000	50
[illegible]	28600	62
[illegible]	41400	80
[illegible]	53900	1 28
[illegible]	62000	1 53
[illegible]	80000	2 08

BOLTS AND NUTS—STEEL—ALUM. ALLOY

L—Length Under Head to End of Bolt—Inches

Size No	Steel: Hex Head Bolt	Steel: Eye Bolt	Steel: Eye for Cable Bolt	Steel: Castellated Hex Nut	Steel: Plain Hex Nut	Alum. Alloy: Hex Head Bolt	Alum. Alloy: Castellated Hex Nut	Alum. Alloy: Plain Hex Nut
6—40					0025			
10—32	003+ 008 L	010+ 008 L	003+ 006 L	003	0043	0011+ 003 L	0018	
1/4—28	004+ 014 L	016+ 014 L	010+ 014 L	008	0068	0014+ 005 L	0029	0035
5/16—24	009+ 025 L	033+ 033 L	033+ 033 L	012	0102	0032+ 0039 L	0043	0033
3/8—24	016+ 031 L	048+ 051 L	043+ 031 L	014	0130	003+ 0111 L	0050	0043
7/16—20	033+ 043 L	088+ 045 L		033	030			
1/2—20	031+ 036 L	138+ 036 L		037	051			
9/16—18	033+ 070 L	326+ 030 L		031	060			
5/8—18	087+ 096 L			104	073			
3/4—16				120	090			

MACHINE SCREWS AND NUTS

Size No	Wt per Inch Overall Length Flat Head	Wt per Inch Overall Length Round Head	Weight Each Hex Nuts
0—80			0005
1—32			001
2—64			003
3—36			002
4—48			0035
5—44			0033
6—40			0023
8—36			004
10—32	0033	0063	0045

COTTER PINS

Diameter	Weight per In
[illegible]	0011
[illegible]	0022
[illegible]	0045
[illegible]	0067
[illegible]	0101
[illegible]	0133

WASHERS

Size Bolt No	Weight
10	0.1
[illegible]	0166
[illegible]	0240
[illegible]	0.33
[illegible]	0665
[illegible]	0832
[illegible]	136
[illegible]	146

SCREWS—WOOD

Size	Rd Head Brass	Rd Head Steel	Flat Head Alum. Alloy
2	0012	0011	0024
3	0016		00035
4	0034	0033	00033
5	.031		00099
6	0039	0036	00133
7			00146
8	0056	0052	00138
9			00211
10	0038	0075	00331
11			00373
12	0096	0090	00307
13			00533
14		00107	
16		0016	00330

CABLE—BOMB AND FLARE
[illegible] 7 x 3 Extra flexible 0145 lb per ft

CABLE—PHOSPHOR BRONZE
50 lb. tensile strength 004 lb per ft

CHAIN

	Type	Pitch	Roller Diameter	Ultimate Strength	Pounds per Foot
Diamond No 9	Block	[illegible]		1500	246
Diamond No 149	Roller	[illegible]	400	4300	528
Baldwin No 116	Roller	[illegible]	[illegible]	2900	323
Baldwin No 100	Roller	[illegible]	400	4300	364
Baldwin No 9	Roller	[illegible]	[illegible]	3300	1 000
Baldwin No 27	Roller	[illegible]	[illegible]	12300	1 890
Baldwin No 301	Block	[illegible]		1000	236
Baldwin No 303	Block	[illegible]		2000	312
Baldwin No 303	Block	[illegible]		3000	397

BOWDEN CASING

BOWDENSOLO (Tinned coiled flexible casing)

Trade No	Diameter Casing Inside	Diameter Casing Outside	Use with Wire or Cable	Weight Pounds per Inch
31	093	165	[illegible] dia	0027
33	138	322	[illegible]	0045
35	193	390	[illegible]	0039
36	225	320	[illegible]	0081

BOWDENITE (Tinned coiled flexible casing with waterproof cotton braid covering)

Trade No		Use with Wire	Weight Pounds per Inch
11	Same as Bowdensolo	[illegible] dia	0034
13	Same as Bowdensolo	[illegible]	0062

PULLEYS

Pulleys Outside Diameter	Moulded Bakelite Micarta Graphite Impreg Core: Cable Size	Weight	Groove Diameter	Groove	Weight
[illegible]	[illegible]	0107	[illegible]	[illegible]	076
[illegible]	[illegible]	033	[illegible]	[illegible]	133
2	[illegible]	049	[illegible]	[illegible]	019
[illegible]	[illegible]	171			

LOCK WASHERS

Size	Bolt Size	Weight
1	8	0005
2	10	0003
3	[illegible]	0028
4	[illegible]	0032
5	[illegible]	0034
6	[illegible]	0048
7	[illegible]	0044
8	[illegible]	0033
9	[illegible]	0140
10	4	0001
11	6	0002
12	12	0013
13	[illegible]	0128
14	[illegible]	0040
15	[illegible]	0031
16	[illegible]	0046
17	[illegible]	0141

FLAT WASHERS

Size	Bolt Size	Wt Brass	Wt Steel
1	[illegible]	0013	0012
2	10	0014	0013
3	10	0016	0015
4	[illegible]	0021	0019
5	[illegible]	0030	0025
6	[illegible]	0038	0030
7	[illegible]	0048	0045
8	[illegible]	0101	0094
9	[illegible]	0135	0122
10	[illegible]	0198	0185
11	[illegible]	0313	0193
12	[illegible]	0326	0312
13	[illegible]	0333	0332
14	[illegible]	041	0381
15	1	0334	0314

Power Plant

FITTINGS—FUEL AND OIL

Lunkenheimer—Air Corps Std

Part	Size	Symbol	Weight Each
Cock shut-off two port key female pipe ends	[illegible]	1263	45
	[illegible]	1263	61
	[illegible]	1263	79
Cock drain for oil male pipe end	[illegible]	159	084
	[illegible]	159	136
	[illegible]	159	260
	[illegible]	159	562
Cock drain for gasoline male pipe end	[illegible]	1039	230
	[illegible]	1039	265
Nipple—union male pipe end male union end	[illegible] pipe end [illegible] tube size	RB3425	036
	[illegible] pipe end [illegible] tube size	RB2425	073
	[illegible] pipe end [illegible] tube size	RB2427	115
	[illegible] pipe end [illegible] tube size	RB7057	162
Coupling—union bearing	[illegible] tube size	RB7171	025
	[illegible] tube size	RB7177	063
Ell—union	[illegible] pipe end [illegible] tube size	B53440	037
	[illegible] pipe end [illegible] tube size	B53442	035
	[illegible] pipe end [illegible] tube size	B55444	129
Tee union	[illegible] tube size	B55412	203
	[illegible] tube size	B27188	300
Cone—union	[illegible] tube size	RB2435	006
	[illegible] tube size	RB2433	016
	[illegible] tube size	RB2459	035
	[illegible] tube size	RB7056	055
	[illegible] tube size	RB7109	060
	[illegible] tube size	RB7623	
Nut—union	[illegible] tube size	RB2443	020
	[illegible] tube size	RB2449	030
	[illegible] tube size	RB2451	043
	[illegible] tube size	RB3055	083
	[illegible] tube size	RB7113	110
	[illegible] tube size	RB3624	230
Nipple—hose	[illegible] pipe end [illegible] tube size	RB3111	021
	[illegible] pipe end [illegible] tube size	RB7336	040
	[illegible] pipe end [illegible] tube size	RB7296	056
	[illegible] pipe end [illegible] tube size	RB3656	085
	[illegible] pipe end [illegible] tube size	RB3210	136
Elbow—hose	[illegible] pipe end [illegible] tube size	B497791	039
	[illegible] pipe end [illegible] tube size	B23618	056
	[illegible] pipe end [illegible] tube size	B23641	115
	[illegible] pipe end [illegible] tube size	B25537	165
	[illegible] pipe end [illegible] tube size	B27110	259
Liners—hose	[illegible] tube size	RB 7070	005
	[illegible] tube size	RB12917	006
	[illegible] tube size	RB 7491	010
	[illegible] tube size	RB 7691	019
	[illegible] tube size	RB 7172	024
	[illegible] tube size	RB 7657	039
Elbow—street	[illegible] pipe end	Fig 261	047
	[illegible] pipe end	Fig 261	095
	[illegible] pipe end	Fig 261	130
	[illegible] pipe end	Fig 261	210
	[illegible] pipe end	Fig 261	375
	[illegible] pipe end	Fig 261	600
Elbow—plain female pipe ends	[illegible] pipe end	Fig 630	051
	[illegible] pipe end	Fig 670	092
	[illegible] pipe end	Fig 670	137
	[illegible] pipe end	Fig 670	216
	[illegible] pipe end	Fig 670	338
	[illegible] pipe end	Fig 670	375

Part	Size	Symbol	Weight Each
Tee—plain female pipe ends	[illegible] pipe end	Fig 631	080
	[illegible] pipe end	Fig 671	143
	[illegible] pipe end	Fig 671	203
	[illegible] pipe end	Fig 671	348
	[illegible] pipe end	Fig 671	490
	[illegible] pipe end	Fig 671	750
Cross—Plain female pipe ends	[illegible] pipe end	Fig 632	089
	[illegible] pipe end	Fig 672	130
	[illegible] pipe end	Fig 672	345
	[illegible] pipe end	Fig 672	380
	[illegible] pipe end	Fig 672	543
	[illegible] pipe end	Fig 672	800
Coupling	[illegible] pipe end	Fig 633	043
	[illegible] pipe end	Fig 673	080
	[illegible] pipe end	Fig 673	110
	[illegible] pipe end	Fig 673	269
	[illegible] pipe end	Fig 633	393
Nipple—close	[illegible] pipe end	Fig 677	012
	[illegible] pipe end	Fig 677	025
	[illegible] pipe end	Fig 677	035
	[illegible] pipe end	Fig 677	055
	[illegible] pipe end	Fig 677	085
	[illegible] pipe end	Fig 677	139
Plug	[illegible] pipe end	Fig 680	033
	[illegible] pipe end	Fig 680	042
	[illegible] pipe end	Fig 680	051
	[illegible] pipe end	Fig 680	110
	[illegible] pipe end	Fig 680	185
	[illegible] pipe end	Fig 680	310
Bushing—reducing	[illegible]	Fig 681	039
	[illegible]	Fig 253	050
	[illegible]	Fig 681	065
	[illegible]	Fig 253	086
	[illegible]	Fig 253	135
	[illegible]	Fig 681	150
	[illegible]	Fig 681	218
Tee		B 32663	.022
Nipple—male ends		RB3209	.023
Nipple—male and female ends		RB7286	.008
Nut—union		RB7225	.008
Cone—union		RB3852	.004
Cock—shut-off male pipe end and male union end	[illegible]	Fig 8519	074
Cock—shut-off two male union ends	[illegible]	Fig 8528	067
Ell—jet assembly	[illegible]	Fig 8343	033
Tee—jet assembly	[illegible]	Fig 8348	038
Pump—primer union ends	[illegible]	Fig 216	426
Pump—Lunkenheimer with shut off cock and handle		D 1299	378

HOSE—FUEL, OIL, AND WATER

Inside Diameter	Outside Diameter	Number Plys	Lbs per Foot
[illegible]	[illegible]	2	131
[illegible]	[illegible]	2	150
[illegible]	[illegible]	2	172
[illegible]	[illegible]	3	219
[illegible]	[illegible]	3	233
[illegible]	[illegible]	3	267
[illegible]	[illegible]	3	291
[illegible]	[illegible]	3	333
[illegible]	[illegible]	3	316
[illegible]	[illegible]	3	415
[illegible]	[illegible]	3	449
[illegible]	[illegible]	3	463
[illegible]	[illegible]	3	510
[illegible]	[illegible]	3	560
[illegible]	[illegible]	3	602
[illegible]	[illegible]	3	632
[illegible]	[illegible]	3	663
[illegible]	[illegible]	3	556
[illegible]	[illegible]	3	850
[illegible]	[illegible]	4	1 128
[illegible]	[illegible]	4	1 260
[illegible]	[illegible]	4	1 354
[illegible]	[illegible]	4	1 470
[illegible]	[illegible]	4	1 583
[illegible]	[illegible]	4	1 920

CLAMPS—HOSE (Ideal)

Nominal Size	Weight
[illegible]	.036
[illegible]	.039
[illegible]	.042
[illegible]	.045
[illegible]	.049
[illegible]	.053
[illegible]	.058
[illegible]	.063
[illegible]	.067
[illegible]	.071
[illegible]	.075
[illegible]	.079
[illegible]	.083
[illegible]	.092
[illegible]	.101
[illegible]	.110
[illegible]	.124
[illegible]	.133
[illegible]	.143
[illegible]	.173

POWER PLANT—PARTS

Engine Control Units		Weight Pounds
Type B-2	Throttle and mixture levers	1 25
Type B-3	Throttle, spark and mixture levers	1 75
Type B-4	Throttle, spark, mixture and altitude levers	2 00
Fuel pump (hand) Type D-1		2 38

TUBING—FUEL & OIL

Copper Tubes Size	Lbs per Foot
[illegible] O D × (035)	042
[illegible] O D × (035)	063
[illegible] O D × (035)	065
[illegible] O D × (035)	082
[illegible] O D × (035)	110
[illegible] O D × (035)	148
[illegible] O D × (035)	197
[illegible] O D × (035)	225
[illegible] O D × (035)	251
[illegible] O D × (035)	304
[illegible] O D × (035)	358
[illegible] O D × (035)	411

PROPELLERS

Engine	Standard Steel Aluminum Alloy: Diameter	Rated R P M	Weight	Curtiss Aluminum Alloy: Diameter	Rated R P M	Weight	Wood: Diameter	Weight
Warner Scarab	8' 9"	1800	51					
Kinner K-5	8' 9"	1850	51					
Velie M-5	7' 6"	1930	46				6' 9"	13
Curtiss Challenger R-600	8' 6"	1850	70					
Curtiss Conqueror V-1550	[illegible]	2200	80					
Curtiss Chieftain H-1640	[illegible]	2200	85					
Curtiss D-12	[illegible]	2300	85	9' 9"	2300	95		
Aeromarine Comet	[illegible]	1850	70					
Le Rhone 6	[illegible]	1850	45				7' 8"	15
Le Rhone 9	[illegible]	1850	43				9' 9"	42
Wright Whirlwind J-5	[illegible]	1900	72					
Wright J-6 R-975	[illegible]	2000	85					
Wright Cyclone R-1750	[illegible]	1900	115					
Pratt & Whitney Wasp	[illegible]	1900	115					
Pratt & Whitney Hornet	[illegible]	1900	115					
Aeolian	[illegible]	1850	36					
Curtiss OX-5	[illegible]	1400	33	8' 6"	1400	33	8' 6"	19
Liberty 12								
Packard 1500	9' 6"	2100	90					
Packard 1500 geared	14' 6"	1250	260					
Packard 1500 geared	12' 10"	1250	360					
Curtiss GV-1550				14' 3"		280		
Packard 2500 geared 2:1	16' 0"	1250	380					

RADIATOR DATA

Tubes—Plain Hex Ends

Size Round Tube	Overall Length	Size Hex Across Flats	Length	Frontal Area of Tube	Sq In Cooling Surface of Tube	Weight Pounds Each	Per Square Foot of Frontal Area—Sq Ft Cooling Surface	Weight Water	Weight Tube
[illegible]	4	313	167	08493	4 11	0064	39 95	6 3	13 9
[illegible]	5	313	105	08495	4 95	0079	40 43	8 0	19 8
[illegible]	6	308	200	08214	3 35	0085	60 67	10 3	23 6
[illegible]	7	308	300	09314	3 36	0145	69 43	13 8	33 6
[illegible]	8	325	250	0985	7 37	0143	63 36	Air cooler	23 2
							81 38	Air cooler	32 3

Approximately 25 sq ft of cooling surface is required per horsepower of motor. Add approximately 20% to dry core weight for weight of shell and mounting brackets. Weight of radiator for 100 horsepower engine 36 to 42 lbs. Weight of oil cooler for 100 horsepower engine 6 to 12 lbs.

STARTING EQUIPMENT

Eclipse Hand and Electric Starters

	Series 6 Inertia Starter for Engines up to 1350 Cu In Displacement: Land Service	Marine Service	Series 11 Inertia Starter for Engines up to 2500 Cu In Displacement: Land Service	Marine Service	Series 7 Inertia Starter for Engines up to 2000 Cu In Displacement	Hand Turning Gear Starters of Engines up to 900 Displacement: Type I B-6 Without Booster Magneto	Type I HB-6 with Booster Magneto
Hand operation	17 3	19 3	18 5	21 5	27	17 5	20
Combination hand and electric operation	24 5	27 5	26 5	30 5	35		
Solenoid switch	3	3	3	3	3		
Push and pull starting switch	16	16	16	16	16		
Crank handle	2 75	2 75	2 75	2 75	2 75		
Crank extension tubing	1 75	1 75	1 75	1 75	1 75		

Heywood pressure injection starter
Starter and equipment—Average weight 36 lbs.

Landing Gear

WHEELS—TIRES—TUBES

Bendix Wheels and Brakes — Dayton Wire Wheel Co

Wheel Size	BENDIX Plain Wheel	BENDIX Wheel and Brake	DAYTON Plain Wheel
14x 3			3
18x 3			6
24x 3			8 0
24x 4		15	
28x 4		17	12 5
30x 5	13	25	
32x 6	16	29	19
36x 8	20	31	26
44x10	40	65	67
54x12		100	

Goodrich	Plies	Tire Weight	Tube Weight
14x 3 smooth	4	3 20	0 67
18x 3 smooth	2	2 82	0 66
20x 4 S B smooth	4	6 08	1 13
30x 4 S B non-skid	4	7 34	1 13
26x 4 S B non-skid	4	9 56	1 14
28x 6 S B smooth	4	8 19	1 70
30x 5 S B smooth	4	10 76	2 31
30x 5 S B non-skid	4	13 60	2 31
32x 6 S B smooth	4	14 46	2 93
32x 6 S B smooth	6	16 50	2 95
32x 6 S B non-skid	4	16 50	2 95
32x 6 S B non-skid	6	17 74	2 95
36x 8 S B smooth	6	26 14	4 77
36x 8 S B smooth	8	30 26	4 77
40x10 S B non-skid	8	47 52	7 35
44x10 S B smooth	8	50 20	8 75
44x10 S B smooth	12	77 70	8 75
54x12 S B smooth	10	97 00	15 11
26x 3 Cl smooth	4	5 30	0 95
26x 4 Cl smooth	4	8 13	1 41
750x125 MM Cl smooth	4	10 08	1 90

SHOCK ABSORBER STRUTS—RUBBER DISCS—ELASTIC CORD

GRUSS AIR SPRINGS

Model	Bore and Stroke	Static Load Each	Weight Each Pounds
18	2x8	650	7
24	2½x4	1000	8
28	2½x8	1000	10½
48	3 x8	1500	14
69	3½x8	2000	18
88	4 x8	2500	21½

CLEVELAND AEROL STRUTS

Model	Piston Diameter	Static Load	Weight Each
CV16	1 625	750	9
CV20	2	1800	10 5
CV26	2 625	2000	15
CV30	3	2500	17 75
CV35	3 5	3750	25
CV40	4	5000	28
CV45	4 5	6000	34
CV47	4 75	7500	36

GOODRICH RUBBER SHOCK ABSORBING DISCS

Compound	Lb./Cu.In.
7 003	0353
25101	0405
16,055	0416

ELASTIC RUBBER CORD

Diameter	Lbs. per Foot — Shock Absorber Cord	Lbs. per Foot — Exercising Cord
[illegible]		011
[illegible]		019
[illegible]		029
[illegible]	050	050
[illegible]	090	090
[illegible]	142	140
[illegible]	200	

Instruments

Instrument	Pioneer Type No	Weight Pounds
1 Air distance recorder	351	0 7
Transmitter	140	1 2
2. Air speed indicator (2¾" dial)	359	1 3
Pitot tube	P5F	0 4
3 Altimeter (2¾" dial)	355	0 7
(6" dial)	360	1 0
4 Bank indicator	350	0 5
	363	0 3
5 Climb indicator (complete fittings)	374	1 8
(with sensitive alt)	374C	1 8
6. Compass, magnetic	56	2 3
	145	4 3
	192	2 3
	356	2 0
	383	2 0
7 Earth inductor compass	301D	
Generator		9 6
Controller		1 1
Indicator	369	0 7
Flexible shafting per foot		0 06
Flexible casing per foot		0 69
Flexible cable per foot		0 05
8 Sun Compass (Bumstead)	334	1 5
9 Flight indicator	82F	2 0
Venturi tube	3F	0 7
10 Speed and drift meter (with base)	54	2 4
11 Speed timer	93	0 2
12 Turn indicator	103C	1 2
	385	1 4
Venturi tube	V5F	0 7
	V74B	0 4

13 Watch rim wind	375	0 5
Flush	394	0 5
8-day stem wind	126	0 8
14 Oil pressure gauge	303	0 4
15 Tachometer	347	0 9
16 Tachometer shaft, per foot		0 03
End fittings		0 1
17 Thermometer Vapor, with 12' tube	306	1 1
with 20' tube		1 3
Liquid, with 12' tube	15	1 5
with 20' tube		1 6
18 Fuel sight gauge	343	0 6
19 Fuel flow meter	378	1 0
20 Fuel level gauge	162B	0 7
Co (with No 118 30' tube)	F162	0 5
21 Fuel pressure gauge	505	0 4
22 Fuel strainer	S709B	1 1
23 Hand fuel pump	137B	2 2
24 Magneto switch (lug)	545	0 9
(flange)	345	1 0
(with key)	396	1 0
(without key)	396B	0 9
25 Octant	206B	2 8

Cabin Chairs, Seats, and Cushions

Make	Type	Weight Without Upholstering	Weight Upholstered
Universal Airplane Chair Co	F S.—Wicker	4 75	9 00
Universal Airplane Chair Co	S A S steel tubing	5 00	6 50
Universal Airplane Chair Co	T A S steel tubing (reclining)	7 00	13 00
Ypsilanti	3890-C—wicker	8 56	16 43
Ypsilanti	385 -C—wicker	8 75 with cushion	10 75
Ypsilanti	3892-C—wicker	8 50	1 43
Ypsilanti	3891-C—wicker	8 56	14 43
Ypsilanti	X3653-C—wicker	8 56	14 43
Aluminum Co of America	Dural reclining (single seat)	6 50	12 06
Aluminum Co of America	Dural reclining (double seat)	12 50	24 56
Farney	Lincoln model wicker	4 75	
Farney	American model wicker	8 125	
Farney	Chicago model wicker	6 50	
Farney	Washington model wicker	5 75	
Farney	Columbia model wicker	7 50	
Farney	Adams model wicker (cotton)	10 125	
Farney	Hamilton model wicker	6 12	

CUSHIONS

Rubber air-inflated	
17x19 air cushion	1 59 lbs.
17x29 air cushion	2 14 lbs.

Paints and Finishes

Berryloid Lacquer Finishes for Fabric Surfaces

3 coats clear dope; 3 coats aluminum dope; 2 coats berryloid; 1 wash coat of thinner	8 7 oz per sq ft.
5 coats clear dope; 2 coats pigmented dope; 1 coat clear exterior 507 lacquer	5 25 oz per sq ft.
1 coat lead oxide primer	40 oz per sq ft
1 coat anti fouling paint	40 oz per sq ft
1 coat navy gray enamel	32 oz. per sq.ft
1 coat varnish	24 oz. per sq.ft.

Electrical Equipment

	Lbs
Landing lights (pair)	17 1
Without streamlines (pair)	10 4
Battery	
40 amp hour	49 5
60 amp hour	64 5
Switches (gun)	1 5
Flare parachute	19 0
Flare bracket	5 0
Navigation lights (3)	7
Switch	1
Blinker	2
Compass lights	2
Rheostat	1
Instrument board light	1
Rheostat	1
Light—dome	25
Very pistol	2 5
Ammeter Weston No 301 50-0-50	5
Ammeter Weston No 354 30-0-30	24
Battery storage 8 volts, 9 amps hours 9 2	
Battery storage 12 volts, 15 amp hours 25 0 container 3 5	
Battery, storage, 12 volts 55 amp hours 38 0 container 4 8	
Battery storage 12 volts, 45 amp hours 68 0 container 6 5	
Battery storage 12 volts 70 amp hours 70 0 container 7 5	
Aux. fuse (3 fuses)	6
Aux. fuse (6 fuses)	7
Generator (25 ampere) engine driven	20 0
Generator (50 ampere) engine driven	25 0
Generator (15 ampere) engine driven	16 0
Generator control box	9 0
Magneto—Dixie booster	0 25
Generator (25 ampere) wind driven with propeller	18 0

WIRE AND CABLE (ELECTRICAL)

Description	Use	Size Number	O D	Number Braids	Wt. per Foot
High tension	Ignition—Magneto to plugs—Starting Magneto to motor magneto	14 B & S GA	7 m m. O D	2	075
Low tension	Lighting—Switches to Magneto; Ignition—Switches to Distributor	14 B & S GA	3 m m O D	2	040
Low tension	Starting—Battery to Starter	4 B & S GA	375 in. O D	1	167
High tension	Interior (single wire)	14	[illegible] O D	1 layer rubber, 3 layer tape, 2 layer braid	120
High tension	Interior (single wire)	14	[illegible] O D	1 layer rubber, 3 layer tape, 2 layer braid	120
Low tension	Miscellaneous connections (single wire)	16	[illegible]	1 layer rubber, 2 layer tape	025
Low tension	Miscellaneous (two wire)	14	[illegible]		075
Intercommunication and Radio					
High tension	Antenna circuits (single wire)	14	[illegible]	3 layer rubber	225
Low tension	Antenna circuits (5 wires)	20	[illegible]	1 layer rubber, 1 varnished cambric, 1 colored braid	040
Antenna	Antenna and internal bonding (single)	10	[illegible]	No cover, Cotton center	019
Fixture	Compass coil (single wire)	18	[illegible]	2 layers braid	0097

TECHNICAL REVIEWS

N.A.C.A. Technical Report No 322, Investigation of Air Flow in Open-Throat Wind Tunnels, by Eastman N Jacobs

Tests were conducted on the six-inch wind tunnel of the National Advisory Committee for Aeronautics during May and June, 1928, to form a part of a research on open throat wind tunnels The primary object of this part of the research was to study a type of air pulsation which has been encountered in open throat tunnels, and to find the most satisfactory means of eliminating such pulsations In order to do this it was necessary to study the effects of different variables on all of the important characteristics of the tunnel This paper gives not only the results of the study of air pulsations and methods of eliminating them, but also the effects of changing the exit cone diameter and flare and the effects of air leakage from the return passage It was found that the air pulsations in the six inch wind tunnel could be practically eliminated by using a moderately large flare in the exit cone in conjunction with leakage introduced by cutting holes in the exit cone somewhat aft of its minimum diameter.

N.A.C.A. Technical Report No. 321, Fuel Vapor Pressures and the Relation of Vapor Pressure to the Preparation of Fuel for Combustion in Fuel Injection Engines, by Wm F Joachim and A M Rothrock

This investigation on the vapor pressures of fuels was conducted at the Langley Memorial Aeronautical Laboratory at Langley Field, Va., in connection with the general research on combustion in fuel injection engines. The purpose of the investigation was to study the effects of high temperatures such as exist during the first stages of injection on the vapor pressures of several fuels and certain fuel mixtures, and the relation of these vapor pressures to the preparation of the fuel for combustion in high speed fuel injection engines

It was found that the vapor pressures of the fuels increased rapidly at high temperatures, the rate of pressure increase becoming greater as the temperatures approached the critical value Beyond the critical temperature, the rate of pressure increase was constant except at one or more temperatures in the case of certain fuels and their vapors in which chemical changes took place. The chemical changes in some of the fuels were such that the cooling curves were materially different from those obtained during the heating periods Permanent gases were generated during the heating and cooling periods in the case of the alcohols, gasoline, kerosene, and Diesel engine fuel oil so that the fuels removed from the bomb were materially different from those placed in it The vapor pressures of the fuels differed from each other considerably methyl alcohol having the highest vapor pressure, 4,370 pounds per square inch, and Diesel engine fuel oil the lowest, 140 pounds per square inch, for the maximum temperature investigated, approximately 850 deg F

The data for the vapor pressures of the fuels at high temperatures indicate the compression temperatures required to produce rapid vaporization of the injected fuel for combustion.

N.A.C.A. Technical Report No 318, Speed and Deceleration Trials of U.S.S. Los Angeles By S. J. DeFrance and C P Burgess

The trials reported herein were instigated by the Bureau of Aeronautics of the Navy Department for the purpose of determining accurately the speed and resistance of the U S S Los Angeles with and without water recovery apparatus, and to clear up the apparent discrepancies between the speeds attained in service and in the original trials in Germany.

The trials proved very conclusively that the water recovery apparatus increases the resistance about 20 per cent which is serious, and shows the importance of developing a type of recovery having less resistance.

Between the American and German speed trials without water recovery there remains an unexplained discrepancy of nearly 6 per cent in speed at a given rate of engine revolutions Warping of the propeller blades and small cumulative errors of observation seem the most probable causes of the discrepancy

It was found that the customary resistance coefficients C, are 0 0242 and 0 0293 without and with water recovery apparatus, respectively The corresponding values of the propulsive coefficient K, are 56 7 and 44 6 If there is any error in these figures, it is probably in a slight overestimate of C, and an underestimate of K. The maximum errors are almost certainly less than 5 per cent.

No scale effect was detected indicating variation of C with respect to velocity

Integration OF THE THEORETICAL EXPRESSION FOR *Drag*

By CHARLES BOEHNLEIN
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A GREAT deal of material has been written on the subject of aerodynamics, but very little has been written explaining the mathematics involved In this article, I hope to bring before the reader the explanation of the process of integrating a certain expression which occurs in the development of the expression for the theoretical drag of an airfoil

In N A C A Technical Report, No 116 Part II, is given equation (37) which reads

$$w = \frac{1}{4\pi}\int_0^b \frac{d\Gamma}{dX}\frac{dX}{X'-X} \qquad (1)$$

where w = the downward component of the velocity at the trailing edge of the wing at a distance X' from the left wing tip
b = the span of the wing
Γ = the circulation
X = the running co-ordinate measured from the left wing tip

In order to simplify this problem Prandtl places the origin of X at the center of the wing on the trailing edge, and imposes an elliptical distribution of the circulation simply because this works out better The wing now extends a distance $\frac{b}{2}$ to the right and left of the origin, hence, if Γ_o be circulation at the center of the wing, the equation for this elliptical distribution will be

$$\frac{X^2}{\left(\frac{b}{2}\right)^2} + \frac{\Gamma^2}{\Gamma_o^2} = 1.$$

Solving this equation for Γ results in

$$\Gamma = \Gamma_o\sqrt{1 - \frac{X^2}{\left(\frac{b}{2}\right)^2}}$$

The radical sign really demands a $\pm$ sign, but in this development only the positive half of the ellipse is used Differentiating this expression gives:

$$\frac{d\Gamma}{dX} = \Gamma_o\tfrac{1}{2}\left[1 - \frac{X^2}{\left(\frac{b}{2}\right)^2}\right]^{-\frac{1}{2}}\left[\frac{-2X}{\left(\frac{b}{2}\right)^2}\right]$$

which when simplified results in

$$\frac{d\Gamma}{dX} = \frac{-\Gamma_o X}{\frac{b}{2}\sqrt{\left(\frac{b}{2}\right)^2 - X^2}}.$$

The algebraic steps have been omitted and the writer assumes that the reader has the mathematical training of the average engineer Substituting this result into equation (1) and readjusting the limits of the above integral to conform to the new position of the origin, equation (1) becomes

$$w = \frac{1}{4\pi}\int_{-\frac{b}{2}}^{+\frac{b}{2}} \frac{-\Gamma_o X}{\frac{b}{2}\sqrt{\left(\frac{b}{2}\right)^2 - X^2}}\cdot\frac{dX}{X'-X}.$$

X' is now measured from the center of the wing at the trailing edge to the position where the downward component w of the velocity is considered The constant terms in the above integral may be placed on the outside of the integral sign thus

$$w = \frac{-\Gamma_o}{2\pi b}\int_{-\frac{b}{2}}^{+\frac{b}{2}} \frac{XdX}{(X'-X)\sqrt{\left(\frac{b}{2}\right)^2 - X^2}} \qquad (2)$$

The problem is now to integrate

$$\int_{-\frac{b}{2}}^{+\frac{b}{2}} \frac{XdX}{(X'-X)\sqrt{\left(\frac{b}{2}\right)^2 - X^2}}.$$

The constant quantity $\frac{-\Gamma_o}{2\pi b}$ has been set aside for the present The above integral can now be greatly simplified if a new variable t be substituted for X so that

$$t = \frac{2X}{b} \quad \text{or} \quad X = \frac{b}{2}t$$

When X is equal to the limits $+\frac{b}{2}$ and $-\frac{b}{2}$, t takes on the values $+1$ and -1, hence on substitution the expression becomes

$$\int_{-1}^{+1} \frac{\frac{b}{2}t\,d\left(\frac{b}{2}t\right)}{\left(X' - \frac{b}{2}t\right)\sqrt{\left(\frac{b}{2}\right)^2 - \left(\frac{b}{2}t\right)^2}}$$

which on algebraic simplification reduces to:

$$\int_{-1}^{+1} \frac{t\,dt}{(t'-t)\sqrt{1-t^2}} \qquad (3)$$

where $\frac{2X'}{b}$ has been replaced by t'

A discussion of the integrand is now necessary It will be noticed that when t is equal to -1 or $+1$ or t', the integrand becomes infinite, i.e., the denominator

becomes zero and hence the integral is meaningless It will be noticed also that since X' marks a position on the wing it will be less than $\frac{b}{2}$ and hence t' will be less than $+1$ and incidentally greater than -1 or in mathematical language $-1 < t' < +1$ This makes it necessary to integrate across three points, viz, -1, t' and $+1$ where the integrand becomes infinite To integrate across these points some small variable such as ε should be chosen, and the principle value of the integral will be obtained when ε is allowed to approach zero In order that only one of these small variables shall occur in each integral, an intermediate point t_1 between -1 and t' should be chosen and a like point t_2 between t' and $+1$ This will give four integrals such as (omitting the integrand)

$$\int_{-1+\varepsilon}^{t_1} + \int_{t_1}^{t'-\varepsilon} + \int_{t'+\varepsilon}^{t_2} + \int_{t_2}^{1-\varepsilon}.$$

These limits can be represented graphically by a line as shown in Fig 1, with the various above names points located thereon The line represents the trailing edge

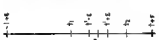

Fig 1

of the wing Then the limit of the above integrals as ε approaches zero will be the principle value of this integral

Now that the limits have been established the process of integration can be continued The integrand of equation (3) can be broken into two fractions by adding and substracting t' thus

$$\frac{(t'-t'+t)dt}{(t'-t)\sqrt{1-t^2}} = \frac{t'dt}{(t'-t)\sqrt{1-t^2}} - \frac{(t'-t)dt}{(t'-t)\sqrt{1-t^2}}$$

$$= \frac{t'dt}{(t'-t)\sqrt{1-t^2}} - \frac{dt}{\sqrt{1-t^2}} \qquad (4)$$

To integrate the first of the above fractions let

$\frac{1}{Z} = t' - t$, then $t = t' - \frac{1}{Z}$ and $dt = \frac{dZ}{Z^2}$

and on substitution the expression becomes

$$\frac{t'dt}{(t'-t)\sqrt{1-t^2}} = \frac{t'\frac{dZ}{Z^2}}{\frac{1}{Z}\sqrt{1-\left(t'-\frac{1}{Z}\right)^2}}$$

which can be reduced to the form

$$\frac{t'dZ}{\sqrt{(1-t'^2)Z^2 + 2t'Z - 1}}.$$

The next step is to take out the quantity $(1-t'^2)$ from the radical and add and subtract the fraction $\frac{t'^2}{(1-t'^2)^2}$ which forms a perfect square of three of the terms under the radical sign The expression now appears as

$$\frac{t'dZ}{\sqrt{1-t'^2}\sqrt{Z^2 + \frac{2t'Z}{1-t'^2} + \frac{t'^2}{(1-t'^2)^2} - \frac{t'^2}{(1-t'^2)^2} - \frac{1}{1-t'^2}}}$$

which reduces to

$$\frac{t'dZ}{\sqrt{1-t'^2}\sqrt{\left(Z+\frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}} \qquad (5)$$

The above is now in one of the fundamental forms of the integral calculus which is

$$\int\frac{dv}{\sqrt{v^2-a^2}} = \log\left(v + \sqrt{v^2-a^2}\right),$$

and integrating expression (5) by the above formula produces

$$\frac{t'}{\sqrt{1-t'^2}}\log\left\{Z + \frac{t'}{1-t'^2} + \sqrt{\left(Z+\frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}\right\}.$$

Since $\frac{1}{Z} = t' - t$, then $Z = \frac{1}{t'-t}$ and substituting this for Z in this last given expression, the integration of the first fraction is completed Thus

$$\int\frac{t'dt}{(t'-t)\sqrt{1-t^2}} =$$

$$\frac{t'}{\sqrt{1-t'^2}}\log\left\{\frac{t'}{t'-t} + \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{t'-t} + \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}\right\} \qquad (6)$$

and

$$\int_{-1+\varepsilon}^{t_1} = \frac{t'}{\sqrt{1-t'^2}}\log\left\{\frac{1}{t'-t_1} + \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{t'-t_1} + \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}\right\}$$

$$-\frac{t'}{\sqrt{1-t'^2}}\log\left\{\frac{1}{t'+1-\varepsilon} + \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{t'+1-\varepsilon} + \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}\right\}.$$

Let the above values of the integral when $t = t_1$ be T_1 for the sake of brevity, then the expression (as ε approaches zero) becomes

$$\lim_{\varepsilon\to 0}\int_{-1+\varepsilon}^{t_1} = T_1 - \frac{t'}{\sqrt{1-t'^2}}\log\left\{\frac{1}{t'+1} + \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{t'+1} + \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}\right\}$$

The expression can be further reduced by algebraic manipulation to

$$\lim_{\varepsilon\to 0}\int_{-1+\varepsilon}^{t_1} = T_1 - \frac{t'}{\sqrt{1-t'^2}}\log\left(\frac{1}{1-t'^2}\right) \qquad (7)$$

Applying the second set of limits to equation (5) gives

$$\int_{t_1}^{t'-\varepsilon} = \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{1}{\varepsilon} + \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{\varepsilon} + \frac{t'}{1-t'^2}\right) - \left(\frac{1}{1-t'^2}\right)^2} \right\} - T_1 \qquad (8)$$

The limit of the above expression cannot be taken since, as ε approaches zero, the fraction $\frac{1}{\varepsilon}$ becomes infinite. The physical reason for this is that at the point t' is the core of a vortex filament and here the velocity is infinite. This point must, therefore, be neglected, but it cannot be unless the effect of the vortex filament on approach from the opposite side $(t' + \varepsilon)$ is equal and opposite to the limit given in expression (8). That is, the two effects must annul one another, hence the limit must be taken as

$$\lim_{\varepsilon \to 0} \left[\int_{t_1}^{t'-\varepsilon} + \int_{t'+\varepsilon}^{t_2} \right].$$

If this limit is zero, then the point t' which is otherwise meaningless can be neglected in the final result.

It will be observed that the limits of the second integral, i.e., $t' + \varepsilon$ and t_2 as well as $1 - \varepsilon$, are in a region where t is greater than t' and hence equation (6) will give the logarithm of a negative number. For values of t greater than t' the integral must be modified as follows:

$$\int \frac{t'dt}{t'-t)\sqrt{1-t^2}} = \int \frac{-t'dt}{t-t')\sqrt{1-t^2}}.$$

The integration of this expression is the same as that of expression (6) except here let $\frac{1}{Z} = t - t'$, then $dt = \frac{-dZ}{Z^2}$.

If the substitution be carried out, it will be found that the minus sign in the integral disappears and the integral becomes

$$\int \frac{-t'dt}{(t-t')\sqrt{1-t^2}} = \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{1}{t-t'} - \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{t-t'} - \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2} \right\} \qquad (9)$$

Substituting the limits of t as follows

$$\int_{t'+\varepsilon}^{t_2} = \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{1}{t_2-t'} - \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{t_2-t'} - \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2} \right\}$$

$$- \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{1}{\varepsilon} - \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{\varepsilon} - \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2} \right\}$$

and if T_2 is used to denote the value of the integral when $t = t_2$ then

$$\int_{t'+\varepsilon}^{t_2} = T_2 - \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{1}{\varepsilon} - \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{\varepsilon} - \frac{t'}{1-t'^2}\right)^2 - \left(\frac{t'}{1-t'^2}\right)^2} \right\} \qquad (10)$$

Combining the results given in integrals (8) and (10) gives:

$$\int_{t_1}^{t'-\varepsilon} + \int_{t'+\varepsilon}^{t_2} = T_2 - T_1 + \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{\frac{1}{\varepsilon} + \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{\varepsilon} + \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}}{\frac{1}{\varepsilon} - \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{\varepsilon} - \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2}} \right\}$$

In the fraction following the logarithm let the numerator and denominator each be multiplied by ε, the expression then becomes

$$\int_{t_1}^{t'-\varepsilon} + \int_{t'+\varepsilon}^{t_2} = T_2 - T_1 + \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{1 + \frac{t'\varepsilon}{1-t'^2} + \sqrt{\left(1 + \frac{t'\varepsilon}{1-t'^2}\right)^2 - \left(\frac{\varepsilon}{1-t'^2}\right)^2}}{1 - \frac{t'\varepsilon}{1-t'^2} + \sqrt{\left(1 - \frac{t'\varepsilon}{1-t'^2}\right)^2 - \left(\frac{\varepsilon}{1-t'^2}\right)^2}} \right\}$$

If ε be allowed now to approach its limit, zero, there results

$$\lim_{\varepsilon \to 0} \left[\int_{t_1}^{t'-\varepsilon} + \int_{t'+\varepsilon}^{t_2} \right] = T_2 - T_1 + \frac{t'}{\sqrt{1-t'^2}} \log \frac{2}{2}$$

and since the $\log \frac{2}{2} = \log 1 = 0$ it follows that

$$\lim_{\varepsilon \to 0} \left[\int_{t_1}^{t'-\varepsilon} + \int_{t'+\varepsilon}^{t_2} \right] = T_2 - T_1 \qquad (11)$$

Substituting in equation (9) the last set of limits (t_2 and $1 - \varepsilon$) gives

$$\int_{t_2}^{1-\varepsilon} = \frac{t'}{\sqrt{1-t'^2}} \log \left\{ \frac{1}{1-\varepsilon-t'} - \frac{t'}{1-t'^2} + \sqrt{\left(\frac{1}{1-\varepsilon-t'} - \frac{t'}{1-t'^2}\right)^2 - \left(\frac{1}{1-t'^2}\right)^2} \right\} - T_2$$

If ε approaches its limit and the result is simplified it becomes

$$\lim_{\varepsilon \to 0} \int_{t_2}^{1-\varepsilon} = \frac{t'}{\sqrt{1-t'^2}} \log \left(\frac{1}{1-t'^2} \right) - T_2 \qquad (12)$$

The value of the first fraction of integral (4) can now

be summed up, hence from expressions (7), (11) and (12) there results

$$\lim_{\varepsilon \to 0} \left[\int_{-1+\varepsilon}^{t_1} + \int_{t_1}^{t'-\varepsilon} + \int_{t'+\varepsilon}^{t_2} + \int_{t_2}^{1-\varepsilon} \right] = T_1 - \frac{t'}{\sqrt{1-t'^2}} \log \left(\frac{1}{1-t'^2} \right) + T_2 - T_1 + \frac{t'}{\sqrt{1-t'^2}} \log \left(\frac{t'}{1-t'^2} \right) - T_2 = 0$$

Therefore, the principle value of

$$\int_{-1}^{+1} \frac{t'dt}{(t'-t)\sqrt{1-t^2}} = 0$$

The second fraction in expression (4) can be very easily integrated since it is a fundamental form as it stands, hence

$$\int \frac{-dt}{\sqrt{1-t^2}} = \text{arc cos}\ t,$$

and the integrand becomes infinite for only two of the points of Fig. 1, i.e., -1 and $+1$ the principle value of the above integral then is

$$\lim_{\varepsilon \to 0} \int_{-1+\varepsilon}^{1-\varepsilon} \frac{-dt}{\sqrt{1-t^2}} = \lim_{\varepsilon \to 0} [\text{arc cos}(-\varepsilon) - \text{arc cos}(-1+\varepsilon)]$$
$$= \text{arc cos}(1) - \text{arc cos}(-1)$$
$$= 0 - \pi = -\pi$$

The principle value of the complete integral may now be written as

$$\int_{-\frac{b}{2}}^{+\frac{b}{2}} \frac{XdX}{(X-X')\sqrt{\left(\frac{b}{2}\right)^2 - X^2}}$$

$$\int_{-1}^{+1} \frac{tdt}{(t-t')\sqrt{1-t^2}} = -\pi$$

Equation (2) on substitution of $-\pi$ becomes

$$w = -\frac{\Gamma_o}{2\pi b}(-\pi) = \frac{\Gamma_o}{2b}$$

The last equation is usually written in many aerodynamic textbooks directly following integral (2). If the above discussion were included in aerodynamic textbooks, it would greatly simplify the subject for the average engineering student. The writer feels that more attention should be paid to this phase of the work.

TECHNICAL PUBLICATIONS RECEIVED

N.A.C.A. Technical Note No. 317, Tests of Four Racing Type Airfoils in the Twenty-Foot Propeller Research Tunnel, by Fred E. Weick.

N.A.C.A. Technical Note No. 318, Full Scale Investigation of the Drag of a Wing Radiator, by Fred E. Weick.

N.A.C.A. Technical Note No. 319, Some Experiments on Autorotation of an Airfoil, by Shotswell Ober.

N.A.C.A. Technical Note No. 320, The Drag and Interference of a Nacelle in the Presence of a Wing, by Eastman N. Jacobs.

N.A.C.A. Technical Note No. 321, The Impact on Seaplane Floats During Landing, by Th. von Karman.

N.A.C.A. Technical Memorandum No. 530, Travel of the Center of Pressure of Airfoils Transversely to the Air Stream, by Richard Katzmayr, from Berichte der Aeromechanischen Versuchsanstalt in Wein Volume I, Nov. 1, 1928.

N.A.C.A. Technical Memorandum No. 531, Welding Rustproof Steels, by W. Hoffman, from Autogene Metallbearbeitung, Dec. 15, 1927, Vol. 20.

N.A.C.A. Technical Memorandum No. 532, Welding of Stainless Materials, by H. Bull and Lawrence Johnson, from Industrial Gases, March and June, 1928.

N.A.C.A. Technical Memorandum No. 533, Handley Page Metal Construction, from Flight, May 9, 1929.

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N.A.C.A. Aircraft Circular No. 102. The Fairey III, F (British). A general purpose biplane.

General Electric Review paper, The Welding of Ferrous and Non-Ferrous Metals by the Atomic-hydrogen Flame, by R. A. Weinman, Research Laboratory, General Electric Company.

Bureau of Standards Research Paper No. 77. A Course-Shift Indicator for the Double-Modulation Type Radiobeacon, by H. Diamond, Radio Engineer, and F. W. Dunmore, Physicist.

Bureau of Standards Research Paper No. 78. Relative Visibility of Luminous Flashes from Neon Lamps and from Incandescent Lamps With and Without Red Filters, by F. Chapin Breckenridge, Associate Physicist, and J. E. Nolan, Junior Engineer.

Bureau of Standards Simplified Practice Recommendations R28-29, Sheet Steel.

An Announcement

In the forthcoming issues of AVIATION, *the material formerly published in the Aeronautical Engineering Section will be distributed in the feature section of the magazine weekly instead of appearing monthly as heretofore. This policy has been adopted mainly in an effort to provide our readers with a diversity of material in each weekly issue. It will enable us also to publish a greater quantity of technical material and will provide articles of this type in each issue rather than in only a few.*

The remaining articles on "Analysis of the Wing and Other Indeterminate Structures" by Jean Fradiss and Armand Thieblot of the Fokker Aircraft Corporation, as well as other technical material that we planned to publish in the engineering section will appear among the feature articles in early issues.—Ed.

ESTIMATION OF THE CHARACTERISTICS OF *Modified Airfoils*

By SHATSWELL OBER
Massachusetts Institute of Technology

IN THE design of airplane wings it is often convenient to change somewhat the ordinates of existing airfoil sections in particular to increase or decrease the thickness slightly for structural reasons This may be carried out in two ways, either all ordinates may be multiplied by a satisfactory fraction, or the median line may be kept constant and the half ordinates varied The first method keeps the wing of the same general type i e, concave, flat, or convex bottomed, while the second changes its shape from concave to convex as thickness is increased Perhaps the first is the more usual and simpler method of modification

In this case if the aerodynamic characteristics of the original wing are known those of the changed section may be estimated with reasonable accuracy if the change in thickness is not excessive, and the new thickness does not exceed 15 per cent The method depends on the theorems of Dr Max Munk for the determination of the angle of zero lift,[1] and experimental results of the variation of drag

First the angle of zero lift measured from the chord line varies directly as the thickness Second the slope of the lift curve is independent of the thickness up to the limit of thickness imposed Therefore the lift at zero degrees is proportional to the thickness

At $O°$

$$K_y = K_{yo} \times \frac{t}{t_o}$$

At any angle α $\quad K_y = K_{yo} \times \frac{t}{t_o} \quad \frac{dK_y}{d\alpha}$

K_{yo} = lift coefficient of original wing at $O°$
t_o = thickness of original wing
t = thickness of modified wing

$\frac{dK_y}{d\alpha}$ = slope of lift coefficient curve

This expression gives the new lift for angles where the lift curve may reasonably be considered a straight line The effect of change of thickness on the maximum lift coefficient is less certain A fair estimate is to increase the K_y 0 00015 for each 0 01 increase in thickness ratio (t/chord)

The best method of computing the change in drag requires the use of the familiar separation of the airfoil drag into induced and profile drag At any angle of attack the new induced drag can be determined from the new value of K_y and the profile drag may be considered proportional to the thickness

At any α $K_{xp} = K_{xpo} \times \frac{t}{t_o}$

$$K_{xi} = \frac{125\, K_y^2}{R}$$

$$K_x = K_{xi} + K_{xp}$$

K_{xp} = profile drag coefficient of new section
K_{xpo} = profile drag coefficient of original airfoil at $\alpha°$
K_{xi} = induced drag coefficient

The above methods give good approximations of lift and drag Unfortunately there seems to be no simple method of finding the change in center of pressure as well The reason is that the moment diverges more and more from its theoretical value as the camber of the airfoil is increased For small changes in thickness the following expression may be used at equal values of K_y, not equal angles.

$$\frac{C\,P - 0\,27}{C\,P_o - 0\,27} = \frac{t}{t_o}$$

$C\,P$ = new location of center of pressure as a fraction of chord
$C.P_o$ = original center of pressure at same K_y

[1] N.A.C.A Technical Note No 122 and Technical Report No. 217

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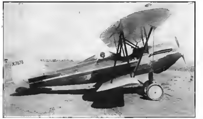

William Winkle of the Brunner-Winkle Aircraft Corporation, piloted a demonstration Bird plane like this when he won the twenty-mile race staged at the dedication of Fitzmaurice Field, Massapequa, L. I

AT the dedication of Fitzmaurice Field, Massapequa, L. I., William Winkle of the Brunner-Winkle Aircraft Corporation, piloting a demonstration Bird plane, won the twenty-mile handicap race using Socony Aviation products.

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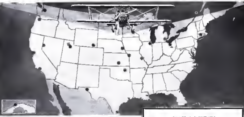

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Warner Aircraft Corp.
Wright Aero Corp.

STROMBERG

growing with aviation

Years ago when aviation was in the experimental stage Stromberg was experimenting, too, with an aircraft carburetor. One that would be dependable, light. That would supply the proper fuel mixture to the engine at all speeds, in all positions—efficiently and economically.

Such a carburetor was developed. The difficulties of propeller blast and upside down flying were overcome. A dependable, durable, economical carburetor was designed and built.

The aviation world quickly recognized the remarkably fine performance of Stromberg carburetors. With the result that over 90% of American aircraft flying today are Stromberg equipped. And—as aviation grows, and new planes and new engines are developed, inevitably builders turn to Stromberg for the solution of their carbureting problems.

STROMBERG MOTOR DEVICES COMPANY
58-68 E. Twenty-fifth Street, Chicago, Ill.

Factory Branches

New York, N. Y. Detroit, Mich. Minneapolis, Minn.
Kansas City, Mo. London, England

What's the key to good Airport Lighting?

By E. J. DAILEY
Lighting Sales Manager
Graybar Electric Company

This is Number 5 of a series of advertisements whose purpose it is to reduce the information on airport lighting to its simplest terms.

1. What is the "A-B-C" of good Airport Lighting?

(A) The properly lighted field is easily found at night. (B) It is easily identified. (C) It is as easy and safe to land upon by night as by day.

2. How are these conditions best achieved?

The government requirements for an "A" rating constitute an excellent gauge of a well-lighted field. The Department of Commerce lists seven requirements: An airport beacon. Boundary lights. Obstruction lights. Hangar floodlighting. An illuminated wind direction indicator. A ceiling finder.

3. In more detail, what is the specific meaning of the seven requirements?

The beacon which locates the field, should rotate a beam of 100,000 candlepower. White or yellow light to mark the usable part of the field, with green locating best approaches and red indicating hazards are necessary. Hangars should be floodlighted to aid the pilot in judging height. The height of the "ceiling," or overhead clouds, is estimated by use of a narrow beam searchlight.

The wind direction indicator must be visible from any direction. And finally, field floodlighting should adequately picture the field, but without blinding glare to the pilot.

4. What is the most important general fact about Airport Lighting?

Equipment alone does not mean good airport lighting. Correct *application*, based on the individual requirements of a field, is the final secret of good airport illumination.

5. How may correct application be secured?

To secure the best application of lighting equipment, it is advisable to call in expert advice.

It may be suggested, at this point, that Graybar's Airport Lighting Department is at all times ready to offer its cooperation and experience in planning and recommending field equipment... Here is a coupon below to save you time.

THE GRAYBAR TAG— SYMBOL OF DISTRIBUTION

GraybaR

Successor to *Western Electric* Supply Dept.

Offices in 72 principal cities

GRAYBAR ELECTRIC CO.
Graybar Bldg., New York, N. Y.
Gentlemen
Please send us more information on Airport Lighting
Name
Address
Av 5

AIRPORT · LIGHTING

BUYERS OF PLANES ARE TURNING TO COLONIAL DEALERS

★

Thruout New York State, New England and Eastern Canada, hundreds of passengers and tons of mail have traveled over the Colonial System. At the principal cities within this area, pilots make constant use of Colonial Service.

It is only natural that buyers of planes are turning to Colonial dealers to select the type of ship best suited to their needs.

Colonial offers a complete line. For learning to fly, a FLEET, Model 1 or Model 2, is the plane that Colonial would at once recommend. The price is reasonable too—being $5,485 for Model 1—WARNER-SCARAB—and $4,985 for Model 2—KINNER K5—delivery at the factory.

For the private owner with fifty hours or more of flying time, the Colonial line presents a wide choice,—a CHALLENGER, Model KR 21A, at $4,685, is ideal for the person who wants a small, fast sport ship for pilot and passenger. If one desires an open plane especially suited for cross country flying with capacity for two passengers and pilot, either a CHALLENGER, Model KR 34A at $6,575 F. A. F. or a PITCAIRN Sport Mailwing at $8,500 is desirable. And for utter luxury, the new FAIRCHILD 41, Custom Built Foursome, at $12,900 F. A. F. is now ready. Powered with a Wright 300 H. P. engine, four-place with dual control, and finished to the purchaser's specifications,—it is certainly the last word in a smart cabin ship.

For the operator of a charter service who wishes the most efficient plane for passenger hopping, Colonial dealers offer a STANDARD, Model D-25, at $9,750 F. A. F.

For an organization requiring for the use of its executive personnel a cabin plane that can comfortably accommodate a pilot and six passengers, Colonial recommends a FAIRCHILD, Model 71, at $18,900 F. A. F. as the most practical ship.

A few territories are still open for the appointment of a Colonial dealer. For complete information, write to Colonial Flying Service, Inc., 270 Madison Ave., New York City.

COLONIAL
FLYING • SERVICE

★

DIVISION • OF • THE • AVIATION • CORPORATION

THERE IS ONE BEST WAY TO CERTAIN SUCCESS IN AVIATION!

A frank talk to young men who seek fortune and fame in the most fascinating of careers—flying

THERE is a best way to do everything. In aviation training, the Parks way is the best way. Parks Air College is the largest and finest flying school in America—because it has established a *matchless reputation* for *sincere, systematic, thorough, personal training* of every one of its students.

Your choice of an aviation school is a matter of highest importance. Upon it depends your *whole future success* in aviation. Consider this: Parks training, the best and most thorough you can secure, *costs no more* than a course at other schools whose standards of instruction and equipment are far below those of Parks. No other civilian air school has such equipment, or offers such complete instruction, as Parks. Nowhere else is there such a staff of highly experienced flying and classroom instructors. At Parks, only twenty minutes from the great aviation center of St. Louis, is an environment of progress, of solid, substantial business, combined with the homelike atmosphere of other great educational institutions.

At Parks, you are in the hands of men whose whole desire is to make of you a capable, trustworthy pilot—a credit to yourself, your family, the College, and institution. Their interest in you is sincere—and personal.

Decide now. There is an acute shortage of trained pilots, and the number of planes licensed next year is sure to exceed the number of pilots available to man them.

Don't gamble with your future. Start *right*—and start right *now*. The Parks way is the best way—the sure way to success. Mail the coupon today for handsomely illustrated free catalog.

Parks Air College is approved by the U. S. Department of Commerce as a Transport Ground and Flying School—the highest possible Federal classification

PARKS AIR COLLEGE
Room 1051 634 North Grand Avenue
ST. LOUIS MISSOURI

• • • COUPON • • •

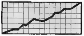
PARKS AIR COLLEGE, Room 1051
634 North Grand Avenue, St. Louis, Missouri

Without cost or obligation to me, please mail your illustrated catalog

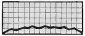
Name..........
Street address..........
City.......... State..........

This is one of a series of advertisements directed nationally to advertising men in an effort to make industrial advertising more profitable to buyer and seller. It is printed in these pages as an indication to readers that McGraw-Hill publishing standards mean advertising effectiveness as well as editorial virility

What is wrong with this star salesman?



With the BBK Crane Company he was a phenomenal success.



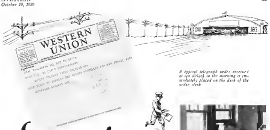
He went with the XYZ Crane Corporation and was a dismal failure.

The difference is not in the salesman nor in the product but in the nature of the Industrial Advertising backing him. Every industrial salesman cannot be a star, but the best that is in him can he developed if the advertising policy and plan are based on achieving Recognition.

How to build this recognition in ten simple steps is graphically explained in the book, "Industrial Marketing at Work." A copy will be delivered by the nearest McGraw-Hill office to any executive responsible for sales or advertising to industry.

McGRAW-HILL PUBLICATIONS

New York, Philadelphia, Chicago, Greenville, Cleveland, San Francisco, Detroit, Boston, St. Louis, London



A typical telegraph order received at ten o'clock in the morning is immediately placed on the desk of the order clerk

Service

that gets things done—PROMPTLY

The story told by these illustrations is typical of the many instances where orders received by the Robertson Supply Division of the Universal Aviation Corporation are shipped the same day as received. With complete stocks of all aircraft supplies on hand and ample personnel to handle the business in spite of its tremendous volume, there is no occasion for delay. Universal service is speedy and satisfactory—the kind for which the aviation industry has long been waiting. Every part leaving this supply depot meets A-N specifications or has been accepted as standard through commercial usage. And prices, in most cases, are lower than can be obtained elsewhere in the industry.

Within the hour, the order is entered on a special duplicating machine and copies sent to departments interested.

As the order comes into the stock room it is turned over to a clerk who takes the merchandise from stock, packs it and attaches shipping instructions

The merchandise is carried by truck to the nearby railroad depot where it is shipped the same day received

Dept W

N 873

UNIVERSAL
ALL AERONAUTICAL SUPPLIES
AVIATION CORPORATION
ROBERTSON DIVISION
LAMBERT-ST. LOUIS AIRPORT, ANGLUM, MISSOURI

ALTITUDE

For five years Travel Air has gained altitude in public confidence, reaching new heights in popularity today . . . More than twelve hundred Travel Airs have been delivered to satisfied owners . . . The nation acclaims Travel Air's sweeping victories at the National Air Races in Cleveland . . . All of which results from Travel Air's policy of building to a most exacting standard. Write for free catalog, "The Story of Travel Air."

TRAVEL AIR COMPANY

Wichita, Kansas

THE STANDARD OF AIRCRAFT COMPARISON

Airport design by Austin for E. B. Cole, Inc. Peoria Illinois

Peoria Prefers *Airport Experience*

WHEN E. B. Cole, Inc, of Peoria, Illinois, decided to provide an airport with up-to-date facilities for flying activities in that community, the airport engineering experience of the Austin Company was called upon to insure the project being handled right

In this vast new field of engineering, where the sum total of all experience is still relatively small, wisdom suggests the employment of an organization which has had a real background of successful experience on a national scale Large resources and unusual facilities are also necessary

Austin Airport Engineers have handled the complete layout and design for important air terminals in nearly a score of cities from Coast to Coast. Looking at the future of air transportation, this organization is planning ahead so that the large investments in airports may be increasingly valuable.

In addition to airport design and construction, Austin designs and builds aircraft factories, hangars, and other aviation structures

With offices in 16 cities, including six on the West Coast, this company is prepared to serve you quickly.

For information on Airport Surveys and Reports, or any aviation building project, phone the nearest Austin office, wire or send the memo

THE AUSTIN COMPANY

Airport Engineers and Builders · Cleveland

New York Chicago Philadelphia Detroit Cincinnati Pittsburgh St. Louis Seattle
Portland Phoenix The Austin Company of California Los Angeles Oakland and San Francisco
The Austin Company of Texas Dallas The Austin Company of Canada Limited

Memo to The Austin Company, Cleveland—We are interested in ☐ Canopy Doors ☐ Hangar ... x ... with ... ft clearance ☐ Airport (Municipal) (Private) containing ... acres ☐ Factory approx. ... sq. ft Name ...
Position ... Firm ... City ... A 10-19-29

Falcon Mail Plane and Bakelite Laminated pulleys used for its control cables Made by Curtiss Aeroplane Motor Co Inc. Garden City N Y

Curtiss Mail Planes rely on pulleys of *Bakelite Laminated*

FLYING day and night, mail planes must be ruggedly equipped to withstand constant service, and the hazards of adverse weather conditions For this reason, Curtiss has adopted Bakelite Laminated cable pulleys for Falcon mail planes and the Curtiss Challenger

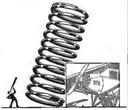
These Bakelite Laminated control cable pulleys are exceptionally strong, although lighter in weight than metal When exposed to moisture, salt air and widely varied atmospheric temperatures, they do not split, crack, shrink or swell Bakelite Laminated pulleys possess a permanently smooth, hard finish, providing quick control response without sticking or binding

Bakelite Laminated is non-corrosive, and non hygroscopic, light in weight, this material is especially adaptable to various aircraft requirements Write for our Booklet 59L, "Bakelite Laminated"

Manufacturers are invited to enlist the cooperation of Bakelite Engineering Service

BAKELITE CORPORATION
247 Park Avenue.. ..New York, N Y
Chicago Office .... 635 W 22nd Street
BAKELITE CORP OF CANADA, LTD
163 Dufferin Street Toronto Ontario

BAKELITE
THE MATERIAL OF A THOUSAND USES



DEPENDABLE

---as to test

---in meeting difficult or fussy requirements

---in being up to specifications

---in service

---in meeting ever-changing delivery schedules

---as to speed for experimental work

May we figure on *your* requirements?

THE WALLACE BARNES CO.
BRISTOL, CONNECTICUT

Barnes made SPRINGS
COLD ROLLED SPRING STEEL · SPRING WASHERS · ASSEMBLIES · SCREW MACHINE PARTS · SMALL STAMPINGS

GREAT LAKES AIRCRAFT CORPORATION at Cleveland Uses NOTRUS HANGARS

These foremost aircraft builders find Notrus Hangars best suited to their purpose Erected in Cleveland's city limits it met their engineering tests of 30 lb wind and 30-lb snow load

Note locker rooms and machinery occupying advantageous side space. This hangar houses 100 ships

Standardized sectional units permit economical construction of any size hangar.

Save a Third — Send for Bulletin

NOTRUS HANGAR CORPORATION
Esperson Building, Houston, Texas

G. L. Mahoney, 422 Elkins Drive, Los Angeles · Guarantee Construction Co. 140 Cedar St. New York · Reed Lumber Co. Hearst Bldg. San Francisco

PERRY-AUSTEN

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Don't Crack
Don't Peel
Don't Rot

Good Take Up
Good Fill
Easy to Apply

These essential qualities of good dopes are demanded by experienced aircraft manufacturers That they are inherent in PERRY AUSTEN DOPES has been proven by Government and manufacturers laboratory tests and in practical service on thousands of military and commercial aircraft

PERRY AUSTEN DOPES are produced by the oldest manufacturer of aircraft dopes in the United States, and they are used by many of America's foremost aircraft manufacturers Ask for our quotations, whether for large or small quantities.

Contractors to United States Government

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Main Office and Works: Grasmere, Staten Island, N. Y.
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Chicago: 810 N Dearborn St. — Tel Superior 6948

Capt. McKinley's New Book on Aerial Photography — Just Out

Full of Vital Information . . that will show you how to get successful results!

Price $5.00

Applied Aerial Photography

By Capt. Ashley C. McKinley
Aerial Surveyor Byrd Antarctic Expedition

Treats in Detail Such General Topics as:

—Ground Preparation
—Photographing the Area
—Design of a Photographic Laboratory
—Developing the Aerial Film
—The Inspecting and Numbering of Negatives
—Making the Prints.
—Preparing the Map From or With the Prints

This book will give you a practical working knowledge of modern aerial cameras, photographic emulsions and photographic processes Every little practical detail is set forth in the author's usual clear and forceful style The book is beautifully illustrated and contains a splendid Bibliography and Index

There are thirty pages on Oblique Aerial Surveys by A. M Narraway Chief Aerial Engineer, Department of the Interior Canada

The subject of the book is fascinating—the presentation is systematic and complete the material is authoritative This book will be THE BOOK on this subject for some time to come

Order a Copy on Approval—Mail the Attached Coupon

A Wiley Book

On Approval Coupon

John Wiley & Sons Inc., 440 Fourth Avenue New York
Gentlemen Kindly send on ten days approval McKinley's "Applied Aerial Photography" If satisfactory I agree to remit $5.00 otherwise the book will be returned

Name
Address
Reference
A 10-19-29

WHERE TO FLY

— ALABAMA —

MONTGOMERY SCHOOL OF AERONAUTICS
MONTGOMERY AIRPORT
Montgomery Ala

Get primer and learn to fly with us where climatic conditions permit daily instruction . . . Send for our literature

— CALIFORNIA —

— CONNECTICUT —

L & H
FLYING SCHOOL
Hartford Airport—
at Hartford Conn
PART OF THE
COLONIAL
FLYING SYSTEM

— FLORIDA —

The Insignia of Specialists

Choose your school as you would your doctor
Courses offered that qualify you for Dept. of Commerce License. Write for details

McMULLEN AVIATION COLLEGE
Tampa Fla P O Box 4191
Where every day is a FLYING day

— ILLINOIS —

FOR SUCCESS IN THE AIR TAKE OFF WITH

CONTINENTAL

CONTINENTAL
AIR SERVICES
2420 South Parkway Chicago

— ILLINOIS —

Learn to Fly at a Midwest Airways Corporation school

MIDWEST AIRWAYS CORPORATION
Waco and Ryan Distributors

Eagle Airport School of Aviation . . . Write for literature

— MARYLAND —

LEARN TO FLY
at "The Flyers Paradise"

DEL-MAR-VA, AIRPORT
Hebron, Md

LEARN TO FLY NOW
$15 and $20 per Hour
Fred Avery Flying Service Inc
Easton Maryland

— MICHIGAN —

ALL NEW, HIGH PERFORMANCE EQUIPMENT COMPLETE GROUND AND FLIGHT TRAINING FOR GOVERNMENT PILOT LICENSES

Write

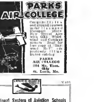
NATIONAL AIRWAYS, INC.

Complete Air and Ground School
TRAVEL AIR AND STINSON PLANES
EXPERIENCED INSTRUCTORS

LEARN TO FLY IN DETROIT

write
HARRY ANDERSON

— MISSOURI —



PARKS
AIR COLLEGE
St. Louis, Mo.

A National System of Aviation Schools

UNIVERSAL AVIATION SCHOOL

— NEW JERSEY —

AIRVIEW FLYING SERVICE, Inc.

Red Bank, New Jersey

IF YOU WANT TO LEARN TO FLY

NEWARK AIR SERVICE

NEWARK METROPOLITAN AIRPORT
Newark N J
30 min ride from New York City

The fact that schools advertising in the WHERE TO FLY section of AVIATION have done so over a period of years is one of the best testimonials to the efficiency of this type of advertising

WHERE TO FLY

— NEW YORK STATE —

THE PERFECT TAKE-OFF FOR YOUR FLYING CAREER...

ROOSEVELT
AVIATION SCHOOL

After the Army pattern—equipment, curriculum, Army-trained instructors. At Roosevelt Field, where Lindbergh, Chamberlin and Byrd hopped from. 45 minutes from Broadway. Dormitory for resident students, and swimming pool now in progress. Write N. J. Boots, Lt. Col., Roosevelt Aviation School Inc., Mineola L I N.Y.

ROCHESTER
FLYING SCHOOL
Rochester Airport—
at Rochester, N Y
PART OF THE
COLONIAL
FLYING SYSTEM

COLONIAL
FLYING SCHOOL
Buffalo Airport—
at Buffalo N Y
PART OF THE
COLONIAL
FLYING SYSTEM

COLONIAL
FLYING SCHOOL
Utica Airport—
at Utica, N Y.
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FLYING SYSTEM

— NEW YORK CITY —

LEARN TO FLY
At a CURTISS SCHOOL

The new Curtiss course is now ready. It was prepared for you by civil and military experts. It is standard at each of the 35 Curtiss schools. It is conducted solely by instructors who have taken the special Curtiss Instructors' Course.
To this splendid modern course only the finest equipment is used—including the highest priced training planes.
Avail yourself of this first-class training and properly prepare for a high place in the flourishing business of aviation.

CURTISS FLYING SERVICE
27 West 57th Street, New York City

THE "WHERE TO FLY" SECTION IS ARRANGED GEOGRAPHICALLY FOR YOUR CONVENIENCE. LEADING SCHOOLS THROUGHOUT THE COUNTRY ARE REPRESENTED IN THIS SECTION. SELECT YOUR SCHOOL FROM THIS CONVENIENT GUIDE

— OKLAHOMA —

AMERICA'S FINEST AVIATION SCHOOL

SPARTAN
SCHOOL OF AERONAUTICS

TULSA, - - - - OKLA

— PENNSYLVANIA —

STULTZ FIELD
TIPTON, PA

Four Way Field
80 Acres

Complete primary and advanced ground and flying courses
All equipment and personnel licensed by both State and Federal Departments of Commerce. Write for booklet

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PITCAIRN AVIATION
of Pennsylvania, Inc.

10-, 20- and 50-Hour Flying Courses leading to federal licenses conducted at Pitcairn field Willow Grove Pa., one of the largest in the East, in midst of ideal flying country. All year-round school. Modern flying equipment. No liability bond required. Write for Illustrated Booklet.

Pitcairn Field Willow Grove Pa

— TEXAS —

STUDENT INSTRUCTION
AERIAL SURVEYS
CHARTER TRIPS
"IDEAL ALL-YEAR FLYING"
TEXAS FLYING SERVICE, INC.
FORT WORTH CLUB BUILDING
FORT WORTH TEXAS

BEST TRAINING
AT
LOWEST PRICES

SOUTHERN AIRWAYS SCHOOLS

Professional Services

The Laboratories and the New Windtunnel of the Tubular Air-Craft Corp.

are now open for manufacturers and private individuals desiring to determine the worthiness of their patents or inventions dealing with new type of Airplanes, Helicopters, Ornithopters etc.
Actual flying models, windtunnel and demonstration models made. Low rates. For further information write

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Airport
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2210 Park Ave.
DETROIT
Suite 247 Write or Wire

Aeronautical Engineering
Aeroplane Design
Airport and Airline Layout
Stress Analysis—Plant Layout and Research
By Competent Engineers
SUPERIOR AIR SERVICE
Chicago Ill.

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Don't Lose Your Rights To Patent Protection
Before disclosing your invention to anyone send for free blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed
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If You Need Expert Advice on Engineering Problems
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AIRCRAFT ENGINEERS INC.
Consultants for the Aircraft Industry
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Complete Stress Analysis
Development of New Designs

This Service Directory

is designed to give you the kind of services that will be of real value to your business.

Take advantage of it.

AIRCRAFT SERVICE DIRECTORY

"Where To Buy It"

USE THIS HANDY BUYERS GUIDE WHEN YOU ARE IN NEED OF AVIATION MATERIAL OR SERVICES. IF YOU DO NOT FIND WHAT YOU WANT ADVERTISED HERE—

WRITE TO

Searchlight Dept.
Tenth Ave. at 36th St., New York City

Consult the

"Professional Service" Directory

and the

"Where To Fly" Section

on

Page 47

SEARCHLIGHT SECTION

EMPLOYMENT and BUSINESS OPPORTUNITIES—USED and SURPLUS NEW EQUIPMENT

UNDISPLAYED—RATE PER WORD
Positions Wanted, Positions Vacant and all other classifications excepting equipment, 10 cents a word, minimum $2.50 an insertion. 10 cents a word if a box number address care of any of our offices is used.
Proposals, 40 cents a line an insertion.

INFORMATION
Box Numbers may be in care of our New York, Chicago or San Francisco offices.
Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH
1 to 3 inches .... $8.00 an inch
4 to 7 inches .... 7.75 an inch
8 to 14 inches .... 7.50 an inch
Other spaces and contract rates on request.
An advertising inch is measured vertically on one column. 3 columns—30 inches—to a page.

FOR SALE

AIRPLANE motors: Hispano-Suiza A, 150 hp. Hispano-Suiza E, 180 hp. Siemens-Halske and Curtiss OX-5 motors, all in excellent condition. OX-5s at especially attractive prices. Write American Eagle Aircraft Corporation, Purchasing Agent, Fairfax Airport, Kansas City, Kansas.

BIRD OX-5 motor, perfect condition, $2,800. Call or write James Inglis, 132 Market St., Paterson, N. J. Phone Sherwood 2412.

FOR SALE: Salmson 9 cylinder radial engines, Model Z-9, $250 each. These engines are completely dismantled and crated, correctly as received. Most of them are new although some have had approximately fifty hours. All in good shape, complete and serviceable. A very dependable engine and the only opportunity today to acquire an advanced type of engine at this price. Splendid for instruction or experimental purposes. Menasco Motors, Inc., 6718 McKinley Ave., Los Angeles, Calif.

FOR SALE: New $300 Irvin air chute. Purchased May 1929. Never worn nor used. Original pack. Substantial savings. A. G. Phelps, 209 Dixon Bldg., Missoula, Montana.

FOR SALE: All parts for J-1 Standard, also rebuilt OXX-6 Curtiss motor, propeller, landing gear, tires, wheels, wings, fuselage and instruments. Write for price. Ben Eisenman, Sheboygan, Wis.

Travelair Speedwing Curtiss Challenger Engine
Flown less than fifty hours. Complete set of instruments, brakes, self-starter, etc. Price $5,000. Stergel, Columbus 7700—70 Columbus, New York City.

Priced To Sell
1 Travel Air Cabin J5CA
72 hour top
1 Travel Air Biplane J5CA
120 hour top
1 OX-5 Travel Air—Duals
All in practically new condition—insured against fire and theft—never been cracked. Whirlwinds equipped with Heywood starters—steel propellers.
Wire or Write
Dixie Davis Flying Field Corp.
Cincinnati O.

FOR SALE
STEARMAN
Wright J-5 Motor, excellent condition. Never crashed. Time flown 350 hrs. Equipped with complete Pioneer instrument board and night flying accessories, spare gas tank. Change of equipment only reason for sale.
Cox & Stevens Aviation Corporation
631 Fifth Avenue New York City

FOR SALE

FOR SALE: Travel Air biplane OX-5, re-covered this year, motor recently overhauled, a bargain at $1,700. Yellow Cab Airways, Inc., Des Moines, Iowa.

FOR SALE—One Tapered wing Waco J-5 Wright, with 120 hours total time ship and motor. Has special instrument board, dual controls, special stream lining, oleo strut landing gear. This ship has never been damaged, like new, $9,000. W. F. Marshall, 916 West Fifth St., Waterloo, Iowa.

FOR SALE: OX-5 Standard J1, excellent condition. Motor turns 1,425. D. H. landing gear. Price $325. S. J. Barber, Clements, Minn.

FOR SALE—Waco-220 Whirlwind. New July 1st. Beautiful paint job. Metal propeller. Bendix brakes. Never cracked. Always kept in hangar. Will sacrifice for $5,200 for quick sale. Roy G. Bernhard, Robbinsdale Airport, Robbinsdale, Minn.

90,331
Horsepower
FOR SALE
312 Engines
15 Different Sizes
11 Different Makes
New, Overhauled, Used
28, 30, 35, 50, 60, 80, 88, 90, 100, 150, 180, 220, 300, 410, 420 H.P. motors in the following makes: Curtiss, Hispano-Suiza, Anzani, Liberty, Lawrence, Pratt & Whitney, Renault, Siemens-Halske, Velie, Warner, Wright. Some new ones priced as low as 80c per H.P. Secure my quotations on motors or parts before buying.
KARL ORT, York, Pa.

FOR SALE

FOR SALE: Licensed Eaglerock biplane with new OX-5 motor. Both in excellent condition. All standard accessories. Owner will give reasonable amount of instruction to purchaser. Wm. J. Fritschle, 2206 Richert Ave., St. Louis, Mo.

FOR SALE: Single-place racer similar to Heath's Baby Bullet. Specially built for National Air Races but not finished in time. Expert aerial license. Anzani 60, all steel construction, expert workmanship. Brand new and never cracked. Motor needs minor adjustments. In last flight speed was 178 m.p.h. Cost $4,000 to build; a sacrifice at $2,000 cash. Orville B. Read, 220 Algoma Blvd., Oshkosh, Wis.

FOR SALE: Fairchild, F.C.-2, J-5 motor, 1928. Newly repainted and in good condition, $5,500 cash. Middle States Air Lines, Inc., Municipal Airport, Akron, O.

FOR SALE: OX Standard, fine condition, less motor, $225. OX-5 cylinders with valves, $7.50. New Jaeger tachometer and shaft, $7.50. Compass $7. Air Speed complete $10. Box 2862, St. Anthony Falls P. O., Minneapolis, Minn.

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